Code 582
Flight Software Branch

[Mission Name (Acronym)]

FLIGHT SOFTWARE PRODUCT PLAN

Flight Software Branch – Code 582

Template Version 7.0 – 05/26/05
582-2000-007
(Replace with Mission Product Plan Version)

Goddard Space Flight Center
Greenbelt, Maryland

National Aeronautics and
Space Administration

FORWARD

This document is a skeleton Product Plan intended for use by Code 582 (Flight Software Branch) personnel as the basis for a mission-specific Flight Software Product Plan.

The following style conventions are used throughout:

Text in this style (style name "Normal") is used for text that is equally applicable to all Product Plans and should be included in the Product Plan without modification. All document section headings are in the same category (although their style names vary depending on outline level).

ISO REFERENCE and ISO GUIDELINE text is for reference only – the Tailoring Advice text (described next) gives more domain-specific guidelines. ISO REFERENCE and ISO GUIDELINE text is styled as "hidden text" – it can be toggled on and off with the hide/show paragraph button.

[Text in this style (style name "TAILORING ADVICE") is advice on how to tailor the text in any specific section.]

As the plan is developed, the generic [TAILORING ADVICE] text should be replaced with material that applies to the specific project. ISO REFERENCE and ISO GUIDELINE text can be left in the document, but not printed, or can be removed entirely if desired.

GENERAL TAILORING GUIDELINES

This section includes general tailoring guidelines applicable to the whole document. Specific recommendations are included in applicable sections.

All components of the table of contents should be addressed, but the level of detail is left up to the Team based on flight software complexity and customer needs/expectations. The length and level of detail of the Product Plan should be commensurate with the scope and complexity of the project. Section headings may be added where necessary, but existing headings should not be modified or deleted. If a particular section is not applicable to the specific Product Plan under production, that fact should be noted under the section heading, together with a brief explanation.

Some items of the table of contents are processes which must be included in the Product Plan by reference to approved processes contained in the Library of Approved Team Processes at http://ISD.gsfc.nasa.gov/Iso9k/ISO9001.htm, or by direct inclusion in the Product plan. If new processes are included in the Plan, they must meet the criteria for each specific process specified in Appendix B of the Product Handbook.

The following disclaimer appears on all pages: "Printed copies of this document are for REFERENCE PURPOSES ONLY! The only controlled copy of this document is located on-line at http://xxxxxxxx". This disclaimer should be modified to contain the appropriate URL, but should not be removed.

Finally, in the target Plan, this entire section ("Forward") can be deleted or replaced with product-specific information, except for the following statement, which should be retained:

The Development Team has evaluated the need for statistical testing of the products developed under this Product Plan and has determined that statistical techniques are not required.

SIGNATURES

Submitted by:

_____ _____

Aaa A. Aaaaa/582 Date
Mission Acronym Flight Software Product Development Lead

Approved by:

_____ _____

Aaa A. Aaaaa /582 Date
Mission Acronym Flight Software Systems Manager

_____ _____

Elaine Shell/582 Date
Flight Software Branch/Head

_____ _____

Aaa A. Aaaaa/nnn Date
Mission Acronym Systems Engineer

_____ _____

Aaa A. Aaaaa/nnn Date
Mission Acronym Project Manager

PLAN UPDATE HISTORY

[This table shows the update history for the Product Plan Template. For Product Plans developed using this template, the elements of this table should be replaced with mission-specific Product Plan update information.]

Version	Date	Description	Affected Pages
	09/08/99	Draft in progress – skeleton document created from Appendix C of the Product Development Handbook Rev C.	All
	09/15/99	Draft in progress – sections contain references to applicable ISO 9000-3 guidelines. These were taken from Appendix A of the Product Development Handbook Rev C (corrected in several places).	All
	09/16/99	Draft in progress – ISO 9000-3 references augmented with actual guideline text.	All
	09/27/99	Draft in progress – PP to 9000-3 mapping added in new "Forward" section. Also, document style conventions added to the same section.	Forward
	10/08/99	Draft in progress – general tailoring guidelines added to "Forward section. Tailoring advice removed from section headings & added to section body to clean up table of contents. This could be considered a reference version, prior to next level of tailoring.	All
	11/09/99	Draft in progress – ISO References and Guidelines re-styled as "hidden text" – remains in the document but can be turned on and off with the "show/hide paragraphs" button. Specific tailoring advice added to each section. Section 1.4 (References) added – Product Plan outline has no central place to collect reference documents, although it specifies that revision level must be specified for all referenced documents.	All
	12/06/99	Draft in progress – Elaine Shell's comments incorporated. ISO References and Guidelines moved – now the last element of each paragraph instead of the first.	All
	12/09/99	Draft in progress – More Elaine comments – revisions to Development Phases (4.1.1.1) and corresponding Reviews (4.1.2.8)	All
	12/17/99	Draft in progress – noticed some more problems with the ISO-PP mapping in the Product Development Handbook. Moved several ISO References to fix. Also added several ISO References and Guidelines not previously mapped	All
	12/20/99	Draft in progress – small changes resulting from meetings with Lisa, & also Sally & Gary (580). There will probably be some bigger changes as a result of the latest (9/99) Product Plan outline.	All
	3/31/00	Draft in progress – changes resulting from Code 580/582 management review of the Triana AOCS FSW Product Plan (based on the 12/20 version of this template). After the Triana plan was updated and signed-off, appropriate generic changes were made to this template.	All

Version	Date	Description	Affected Pages
	6/6/00	Draft in progress - includes changes through Section 3 agreed at Branch internal technical walkthroughs.	All
	6/13/00	Draft in progress - includes changes to Section 4 agreed at 5/31 Branch internal technical walkthrough.	Section 4
	6/14/00	Draft in progress – includes changes agreed at 6/12 Branch internal mgmt. walkthrough (mostly sections 1 & 3, some section 3).	Front matter + sections 1, 2, 3
	7/6/00	Draft in progress – includes changes agreed at 6/20 Branch internal mgmt. walkthrough.	Front matter + sections 1, 2
	7/31/00	FSW Lifecycle diagram (7/18 version) added. Version numbers added to all referenced GPGs. Appendix B (mapping to 580 Product Development Handbook outline) added.	Section 4.1.1.1, Section 1.5, Appendix B
3.0	09/27/00	Changes resulting from latest walkthrough with Elaine, and initial review of draft ST-5 Product Plan.	Significant changes to 4.1.1.2 (Phases & Products) and 4.1.2.6 (Inspection & Test Approach)
4.0	08/31/01	Changes resulting from second draft of ST-5 FSW Product Plan, the Swift BAT FSW Product Plan, and walkthroughs of the NGST FSW Product Plan.	Updated reference list, FSW Life-cycle Figure, many changes to Section 4, some changes to Section 5, updates to Appendix B
4.1	02/28/02	Updated references to GPGs and 582 Standards, URLs for 582 reference documents (including this one) added.	Cover page, headers and footers, Section 1.5 (References)
5.0	08/31/02	New section on Lab. Security; additional material on Continuous Risk Management; added specific list of quality records; added instructions & URL for web-based calibration tracking; recommendations from W. Va. IV&V review of ST-5 Product Plan; Product Development Handbook Rev. F updates.	All
5.1	01/31/03	Minor update. Calibration tracking (introduced in previous revision) updated. There's a new company involved and the process isn't clear. Added reference to 582 web page so that when the process becomes clearer we can update the web page and not (hopefully) this document. Reference added to the Staff Planning/Metrics Spreadsheet. It was hoped to include new detailed material on testing from the team developing the 582 Test Plan Template, but it was not ready in time. Should include in next update.	Section 1.5 (References), Section 3.2 Staffing Profile Section 4.1.5 Control of Test Equipment
5.2	05/30/03	Updates to comply with Rev. G of the Product Development Handbook, and change to the PDH web address. Updates arising from 05/28/03 FSB Standards CCB meeting, which baselined a number of reference documents and changed their web addresses, plus several typographical errors.	Section 1.5 (References), Section 4.1.2.8 (Reviews Planned), Appendix B (PDH Outline Mapping) Section 1.5 (References), Section 3.4.3.2 (Electronic Security), Section 4.1.1.1 (Life-Cycle)

Version	Date	Description	Affected Pages
6.0	01/16/04	Updates to comply with Rev. H of the Product Development Handbook Extensive changes resulting from development and walkthroughs of the SDO FSW Product Plan (some sections renumbered).	(No changes except references to PDH) All
6.1	04/16/04	Several DCR fixes: #60 – Distinguish between team and Project CM #61 – replace IPDT with PDT throughout #68 – fix reference to CM Recommended Practice document #72 – remaining changes from SDO review	 Section 3.9 Several pages Section 1.4 Section 4.1.1.2
7.0	5/26/05	DCR #118 – major update to comply with NPR 7150.	All

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1.0 INTRODUCTION

1.1 DOCUMENT PURPOSE

This document is the Product Plan for development of the [Mission Acronym] Flight Software (FSW) system.

This Product Plan is the ISO **quality planning document** for producing the FSW. See Section 1.4 for related details.

There are six major goals for this document:

(1) To describe **what** products FSW Branch will deliver as the [Mission Acronym] FSW system, and what the FSW Branch will need from the Project in order to complete this development.

(2) To define **who** is responsible for producing the products.

(3) To describe the baseline **schedule** for completing the effort.

(4) To specify the **cost** of producing the FSW, as a function of time.

(5) To describe **how** and **where** the work will be carried out.

(6) To reach a mutual understanding and agreement with our customer and other stakeholders on items (1) through (5).

[Use the paragraph above as is, or augment with mission-specific information about the purpose of this plan]

1.2 DOCUMENT ORGANIZATION

Section 1 of this document presents some introductory material, and an overview of the mission and the FSW system to be developed.

Section 2 (Customer Agreement) summarizes the requirements, deliverables, and other mutually agreed aspects of the relationship between the Project and the FSW Branch.

Section 3 (Management Approach) describes how the FSW Branch will manage the FSW development process.

Section 4 (Technical Approach) describes the technical approach to developing, delivering, and maintaining the FSW products.

Section 5 (Product Assurance) describes the Branch approach for ensuring the quality of the delivered products.

Appendix A (Acronyms and Abbreviations) defines the acronyms and abbreviations used in this document.

Appendix B (Waivers) details waivers from the contents of the Product Plan Template requested by the development team. The Branch Head's signature on the Signature page indicates review and acceptance of these waivers.

Appendix C (Mapping to ISD Software Management Plan / Product Plan for Class B & C Software Template) provides a mapping between the ISD Software Management Plan / Product Plan for Class B & C Software Template, and the sections of this document.

Appendix D (System/Subsystem Classification) provides the classifications of the software systems and subsystems to be developed, as required by NPR 7150.2.

Appendix E (Tailoring Matrix for Compliance with NPR 7150.2) shows compliance with the requirements of NPR 7150.2, "NASA Software Engineering Requirements", and provides the tailoring information necessary for Independent Technical Authority (ITA) approval of variants, waivers, or exceptions to the NPR.

1.3 DOCUMENT DEVELOPMENT, REVIEW, APPROVAL, AND UPDATE

This Product Plan will be developed by the FSW Product Development Lead (PDL), and reviewed and approved by members of the FSW Branch and [Mission Acronym] Project, as listed on the signature page.

This document presents a snapshot of planning information that is current at the time of signature. Detailed cost, schedule and other planning information will be maintained by the FSW PDL. The planning information in this document will only be updated if both Branch and Project agree that there is a change in cost, schedule or scope sufficient to merit a re-plan of the software effort. (See Section 1.5 for updates associated with changes to reference documents).

The baseline version of this plan is produced between the Mission Preliminary Design Review and the FSW Design Review. After initial approval, the document will be treated as a Controlled Document (described in Section 5.2.4), placed under Project Configuration Management (CM), and tracked by Information Systems Division (ISD). Changes will be listed in the Plan Update History.

The Product Plan includes the design planning information required by GPG 8700.1 (Design Planning and Interface Management), and the process management information required by GPG 8072.1 (Process Control).

GPG 5330.1 (Product Processing, Inspection, and Test) describes the use of the Work Order Authorization (WOA) to document the processing of Goddard Space Flight Center (GSFC) products. Paragraph 2.1.5 of the GPG recognizes that the WOA may not be appropriate for software development activities, and allows the use of a WOA equivalent document. The WOA equivalent document for the development of [Mission Acronym] FSW is provided by Section 4.1 (Software Development Plan) and Section 5.3.1 (Identification and Traceability of Products) of this Product plan, together with all associated documentation and references.

[Use the paragraphs above, or replace with mission-specific information about the development/update cycle for this plan]

1.4 REFERENCES

This document references explicit versions of several Goddard Procedures and Guidelines (GPGs), and FSW Branch standards documents. The policy with respect to how changes in these documents affect this document is as follows:

The versions referenced are current at the time of writing. If a GPG (or standards document) changes at a point in the development life-cycle after which the referenced process is no longer being used, the reference

in this document will not be updated. For example, if we reference Revision A of the Procurement GPG, and Revision B is released after we have finished all procurements on this project, it would be incorrect to update the reference – the procedure actually used for procurement was Revision A.

If there is a change in a GPG (or standards document) relating to a process which has not yet been completed, the change will be evaluated for impact on the content of this document and the related development process. In this case, the reference will be updated to reflect the new version, along with required changes (if any) to the document. It will not be necessary to update the signature page in this case.

The following documents are referenced in this Product plan:

	??/??/??	ISD Software Management Plan / Product Plan for Class B & C Software Template
GPG 5100.1C	11/9/2000	Procurement
GPG 5330.1D	7/31/2001	Product Processing, Inspection, and Test
GPG 8072.1C	8/9/1999	Process Control
GPG 8700.1C	8/9/1999	Design Planning and Interface Management
GPG 8730.1F	10/22/2001	Calibration and Metrology
582-2001-005	12/09/03	Flight Software Branch Development Work Breakdown Structure (version 3.3) <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>
582-2000-007	??/??/2005	Flight Software Branch Product plan Template (version 7.0) <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>
582-2000-013	02/04/2004	Flight Software In-House Life-Cycle <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>
582-2000-005	10/29/04	Flight Software Branch C Coding Standard (version 1.0c) <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>
582-2000-002	09/25/2003	Flight Software Branch Unit Test Standard <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>
582-2000-004	9/6/2002	Flight Software Branch Mathematical Entity Naming Standard <http://fsw.gsfc.nasa.gov/Internal/DDB/DDB_Latest.cfm?DDBName=StandardsCCB&docnumber=582-2000-004>
582-2005-???	??/??/??	Flight Software Branch Measurement Plan <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>
	various dates	FSB Role Descriptions <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>
	mm/dd/yyyy	[Mission Acronym] FSW Test Plan <http://????>

mm/dd/yyyy	[Mission Acronym] FSW Configuration Management Plan <http://????>
mm/dd/yyyy	[Mission Acronym] FSW Configuration Management Procedures <http://????>
mm/dd/yyyy	[Mission Acronym] FSW Requirements Management Process <http://????>
04/25/2005	FSW Status Reporting Spreadsheet – PDL <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>
mm/dd/yyyy	FSW Point Counting Spreadsheet <http://fsw.gsfc.nasa.gov/internal/StandardsBaselined.cfm>

[Include the paragraph above as is, and add other referenced documents to the end of the list.]

The following web addresses are referenced in this document:

[Modify or add to this table as required:]

System	URL
GSFC Receiving Inspection and Test System	<http://rits.gsfc.nasa.gov/>
GSFC Directives Management System	< http://gdms.gsfc.nasa.gov/gdmsnew/home.jsp>
Lab. Equipment calibration tracking system	<http://fsw.gsfc.nasa.gov/internal/calibration.html>
Goddard Problem Reporting System (GPRS)	<http:// https://gprs.gsfc.nasa.gov/>
ISD Library of Approved Team Processes (Section 2: Control of Documents and Data & Quality Records)	<http://ISD.gsfc.nasa.gov/iso9k/is09001.htm>
ISD Library of Approved Team Processes (Section 3: Control of Customer Supplied Elements)	<http://ISD.gsfc.nasa.gov/iso9k/iso9001.htm>
FSW Branch Internal Website	<http://fsw.gsfc.nasa.gov/Internal/
FSW Branch Risk Management System	<http://fsw.gsfc.nasa.gov/internal/RM/RM_Home.cfm>
FSW Branch Staff Planning/Metrics Spreadsheet	<http://fsw.gsfc.nasa.gov/internal/Help582StaffingSpreadsheet.html>
[Mission Acronym] FSW Document Repository	<http://fsw.gsfc.nasa.gov/internal/[Mission Acronym]/>
FSW problem/change reporting system	<tbs>

1.5 BACKGROUND AND SCOPE

[Insert a high-level overview of the mission – enough to provide a context for the more detailed material to follow]

[Insert a brief (1 or 2 pages) overview of the FSW architecture. It would also be helpful to include an overview (possibly 1 diagram) of the flight hardware, showing the CPU(s) on which the FSW executes, and interfaces with the sensors and actuators. This section will provide a context for the names and descriptions appearing in other sections.]

2.0 CUSTOMER AGREEMENT

This section describes the FSW Branch understanding of the products to be developed, the schedule for development, the resources required, and mechanisms for communicating with the customer. The purpose of this section is to expose these items to the customer as a means of negotiating and documenting a mutual understanding. The customer's signature on the signature page indicates agreement with this section.

2.1 CUSTOMER IDENTIFICATION

[Identify the primary customer for the FSW to be developed. Normally, this will be the Project or other organization that is providing funding for the development effort, has specified the requirements, and will be responsible for accepting the final FSW.

In most cases more than one organization may be involved in addition to the Project customer. Include or tailor the following statements:]

The primary customer for the [Mission Acronym] FSW is the [Mission Acronym] Project. The [Mission Acronym] Project is providing funding for the FSW development, test, validation and on-orbit maintenance, and will supply the mission requirements and oversight of the various organizations involved in the effort.

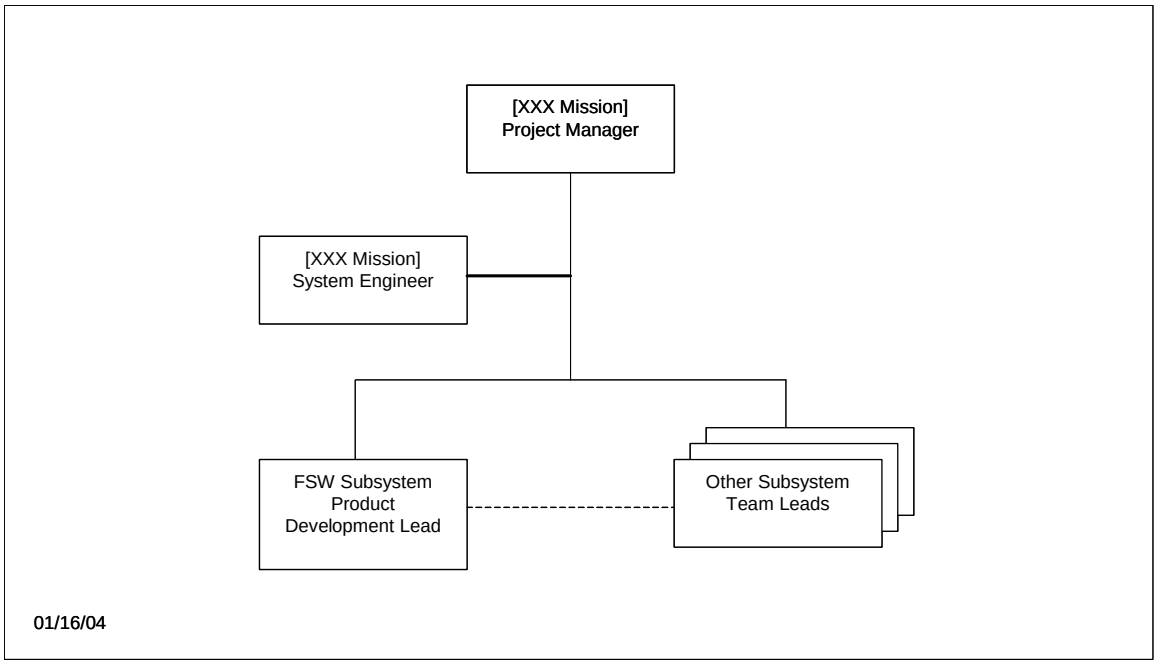
Other organizational interdependencies with the FSW development team are noted in Section 28 (Receivables and Deliverables).

2.2 CUSTOMER GOALS AND OBJECTIVES

[List the primary customer's goals and objectives for the software to be developed. Essentially this amounts to a very high-level statement of the major requirements, probably no more than one or two paragraphs.]

2.3 FSW TEAM PLACEMENT WITHIN CUSTOMER ORGANIZATION

[Show a high-level organization chart depicting the position (and reporting relationships) of the PDL within the customer organization, such as the following example:]



2.4 CUSTOMER INVOLVEMENT

In addition to providing the resources described in Section 2.7, key Project personnel will participate in the FSW development process by:

- Attending and participating in FSW technical reviews
- Participating in FSW Configuration Control Boards (CCBs) to disposition Discrepancy/Change Reports (DCRs)
- Assigning a Quality Assurance (QA) person
- Facilitating timely systems engineering decisions that minimize impact to the FSW teams.

[Specify how the customer will be expected to take part in the development process. Typically, the customer will participate in technical reviews, change control boards, and witnessing acceptance tests. There may be other forms of interaction, such as regular status meetings, participation in working groups, ACS analyst support in FSW test activities, etc.]

[Unless a specific agreement has been made with the customer, include the following statement:]

The Branch will develop a Telemetry Monitoring and Response capability as part of the FSW. This capability will be fully validated to accommodate any mission-specific Fault Detection and Correction (FDC) requirements. However, the mission-specific data checks and stored commands or scripts associated with this capability are to be developed and tested by Project Systems Engineering personnel. As this represents a significant effort, it is important to note that it is not within the scope of the FSW development effort.

2.5 CUSTOMER COMMUNICATIONS

[Include or tailor the following:]

The major vehicles for customer communication include:

- Project Management –
  - The FSW PDL will make regular contact with the Project Management in order to report status, raise development issues, and discuss design decisions. The FSW PDL will attend regularly scheduled Project staff meetings.
  - Communication with the Project will also occur through progress reviews and review of technical documentation.
- FSW Branch – The FSW PDL will attend monthly Branch status meetings covering schedule, staffing, technical progress and issues.
- FSW Maintenance Team -
  - The maintenance team will participate in development activities with the focus of ensuring an easily maintainable [Mission Acronym] FSW system.
  - The maintenance team will be encouraged to participate in internal FSW walkthroughs
  - The maintenance team will be encouraged to review and comment on FSW documents prior to handover of the FSW and its development environment

2.6 REQUIREMENTS SOURCES

[List the source(s) of requirements from which the FSW will be developed. The requirements will be documented in a requirements document to be created by the development team in cooperation with the customer, based on mission requirements supplied by the customer. Any documents referenced in this section must also be added to the list of reference documents in Section 1.4.]

2.7 RESOURCES REQUIRED

The following resources have been negotiated with the [Mission Acronym] Project, based on a launch date of mm/dd/yyyy:

Personnel Resource FTEs	FY01	FY02	FY03	Total FTEs
Civil Servant FTEs	n	n	n	n
Support Service Contractor FTEs	n	n	n	n
Total FTEs	n	n	n	**n**

Resource $	FY01	FY02	FY03	Total $

Resource $	FY01	FY02	FY03	Total $
Support Sub-Contractor Labor Costs	$n,nnn	$n,nnn	$n,nnn	$n,nnn
Other Direct Charges	$n,nnn	$n,nnn	$n,nnn	$n,nnn
Total $	$n,nnn	$n,nnn	$n,nnn	**$n,nnn**

In addition, the following resources will be provided by the Codes indicated:

Personnel Resource FTEs	FY01	FY02	FY03	Total FTEs
GN&C Analysts (Code 570)	n	n	n	n
Flight Ops. Team (Code ???)	n	n	n	n
Total FTEs	n	n	n	**n**

[Describe the resources agreed with the primary customer to complete the development. Include the following:

- Identify the Launch, IOC, and end of design life milestones on which these estimates are based. This can be done by including a Project-provided high level schedule at this point.
- Note that funding represents costs up to a given date, nominally Initial Operational Capability (IOC), with maintenance (if applicable) through end of design life.
- If any special skills are required, mention it here.
- If the effort requires access to special development or test facilities, mention it here.
- Reference the FSB Basis of Estimate (BOE) spreadsheet to show how this estimate was derived. If these figures are constrained by the Project budget, and significantly lower than the BOE, make a note of that here, and add a risk to the Risk Management Section.

2.8 RECEIVABLES AND DELIVERABLES

This section itemizes the major deliverables from the customer, and to the customer.

2.8.1 Receivables to FSW PDT

The following items are required by the Product Development Team (PDT) in order to complete this development effort according to the planned schedule. Although some of these items are obtained from organizations outside of the Project, the FSW Branch considers the Project responsible for ensuring timely availability:

[The following table shows an example; tailor as necessary:]

Element Description	Supplied By	Contact	Need Date

Element Description	Supplied By	Contact	Need Date
Mission requirements	Project		mm/dd/yy
ACS algorithms	Flight Dynamics Analysis Branch		mm/dd/yy
Flight hardware specifications	Project		mm/dd/yy
Dynamic simulator(s)	Project		mm/dd/yy
Ground system(s)	Code 584		mm/dd/yy
Flight data system breadboard	Project + Code 561		mm/dd/yy
Flight data system ETU	Project + Code 561		mm/dd/yy
Instrument simulator(s)	Project		mm/dd/yy
Subsystem simulator(s)	Project		mm/dd/yy
nnn sq. ft. lab. space	Project		mm/dd/yy
Test procedures and associated display pages	FOT		mm/dd/yy
Testing of Fault Detection and Correction (see Section 2.7)	Project Systems Engineering		mm/dd/yy

2.8.2 Deliverables from FSW PDT

The following items will be delivered by the development team as part of this effort:

[Describe the delivery medium for each delivered software product (e.g., CD-ROM, electronic delivery via FTP, installed in EEPROM, etc.) and also for any documentation products (paper copies, electronic distribution via a web site, etc.). Additional detail may be presented in Section 4.2, Process for Transportation, Identification, and Medium of Product. Specify the destination(s) for the software and documentation deliverables. This item may be included by reference.]

Element Description	Supplied To	Destination	Medium
[Mission Acronym] FSW			
Associated Products			

Element Description	Supplied To	Destination	Medium
The [Mission Acronym] FSW and all associated products: • The Software Requirements Review (SRR) presentation package • The Software Preliminary Design Review (PDR) presentation package • The Software Critical Design Review (CDR) presentation package • The FSW Requirements Document • The FSW User's Guide • The FSW Build Test Procedures • The FSW System Test Plan • The FSW Telemetry Definitions Document • The FSW Command Definitions Document • Required Interface Control Documents (ICDs) • The FSW Acceptance Test Results Review package	Project		
The FSW validation & test facility	FSW maintenance team		
Contributions (as required) to: • The spacecraft Operations Concept Review • The spacecraft System Requirements Review • The spacecraft PDR • The spacecraft CDR • Independent Acceptance Testing support • Spacecraft Integration and Test (I&T) support • Spacecraft mission operations reviews	Project		

[The details of how deliverables will be identified and delivered will be presented in Section 4.2 (Process for Transportation, Identification, and Medium of Product), the "when" is covered in Section 3.8 (Schedules).]

2.9 AUTHORITY FOR CHANGES

[Describe who has the authority to authorize changes in requirements or other controlled items. Normally this Section will simply name the Configuration Control Board (CCB) responsible for the software product being developed. In some cases there may be a hierarchy of control boards. This section could also refer to the project's Configuration Management Plan (CMP) for additional details.

Replace or tailor the following:]

All changes to the baselined FSW requirements, design, or implementation required or requested by any Project element will be forwarded to the FSW development team in writing. Electronic forwarding of changes is preferred. If changes in requirements will result in a change in the software development schedule or cost, the customer will be informed of the estimated impact promptly.

The Project will have final authority for approval of changes affecting cost, schedule or scope. Written authorization for, or concurrence with, the proposed change by the Project will be required.

All changes will be entered into the FSW team problem/change reporting system at:

<http://xxxxxxxxxxxxxxxxxxxxx>

The problem/change system will be used to track the disposition of requested changes.

2.10 ACCEPTANCE CRITERIA

[The details of the acceptance process will be contained in Section 4.1.2.7 - Acceptance Criteria and Objectives. Sometimes they will be contained in an externally referenced document such as a Test Plan. The most important thing to specify in this section is where the acceptance criteria can be found.]

2.11 CUSTOMER TRAINING

[If any training will be supplied by the developers, or by a third party, to enable the customer to use the delivered FSW, describe it briefly in this section.

Describe any training to be provided to the FSW maintenance team.

Replace or tailor the following statement:]

No formal training of the customer will be required. The [Mission Acronym] FSW User's Guide will address the anticipated questions of the FSW maintenance team, and the FOT. The development team will be available to answer additional questions throughout spacecraft I&T and operations.

The FSW maintenance team will be invited to participate in internal code walkthroughs to provide a maintenance viewpoint, and also to become familiar with the FSW prior to assuming maintenance responsibility.

2.12 POST DELIVERY MAINTENANCE

[Include or tailor the following statement:]

Through the completion of on-orbit checkout, maintenance of the FSW will be the responsibility of the FSW software development team. During this period, all modifications to the FSW needed to address bug fixes, enhancements, and upgrades will be performed by or managed by the FSW development team. Changes must be requested through the Project's problem reporting system, and approved by the Project before they are implemented.

After the on-orbit checkout period, maintenance will be the responsibility of the FSW maintenance team. This team will have its own plan describing its requirements, processes, deliverables, and responsibilities.

The FSW development environment, including all tools, products, and documentation, will be delivered in-place to the FSW maintenance team at the conclusion of the development effort.

3.0 FSW MANAGEMENT APPROACH

This section describes how the FSW development effort will be managed.

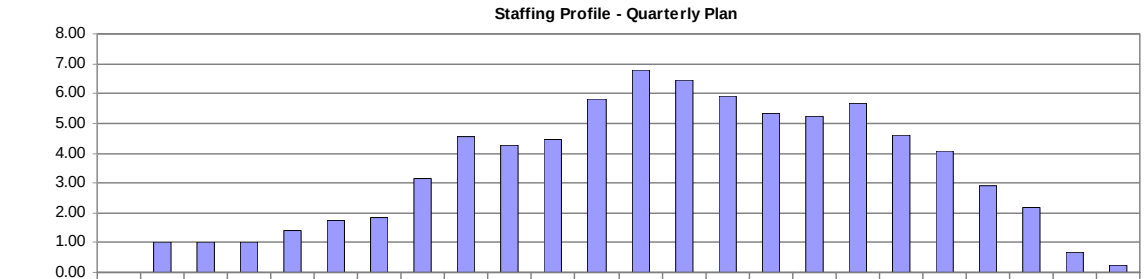
3.1 GENERAL DEVELOPMENT APPROACH

[Include or tailor the following paragraph. If some of the team members will be shared with other projects, mention it here. Also mention any intention of significant software re-use, or significant use of Commercial Off The Shelf (COTS) or Government Off The Shelf (GOTS) software]

A team of FSW developers will be assembled to develop, integrate, test and deliver the [Mission Acronym] FSW system. Team members will include civil servant and contractor personnel. The civil servant team members will be Code 582 software system engineers and software developers.

3.2 STAFFING PROFILE

[Include a proposed staffing profile like the example below (quarterly or half-yearly profiles are also acceptable). The FSW Branch FSW Staff Planning/Metrics Spreadsheet should be used to plan the staffing, and updated on a monthly basis for status reporting. Information about the Staff Planning/Metrics Spreadsheet is available at: http://fsw.gsfc.nasa.gov/internal/Help582StaffingSpreadsheet.html]



	JFM 1997	AMJ 1997	JAS 1997	OND 1997	JFM 1998	AMJ 1998	JAS 1998	OND 1998	JFM 1999	AMJ 1999	JAS 1999	OND 1999	JFM 2000	AMJ 2000	JAS 2000	OND 2000	JFM 2001	AMJ 2001	JAS 2001	OND 2001	JFM 2002	AMJ 2002	JAS 2002	OND 2002
Total LOE	0.00	1.00	1.00	1.00	1.40	1.75	1.82	3.14	4.55	4.27	4.45	5.84	6.77	6.46	5.90	5.34	5.26	5.67	4.61	4.08	2.91	2.20	0.66	0.23

3.3 TEAM DETAILS

This section describes the roles, responsibilities,organization, and interfaces of the development team.

3.3.1 Team Charter

[Include or tailor the following paragraph:]

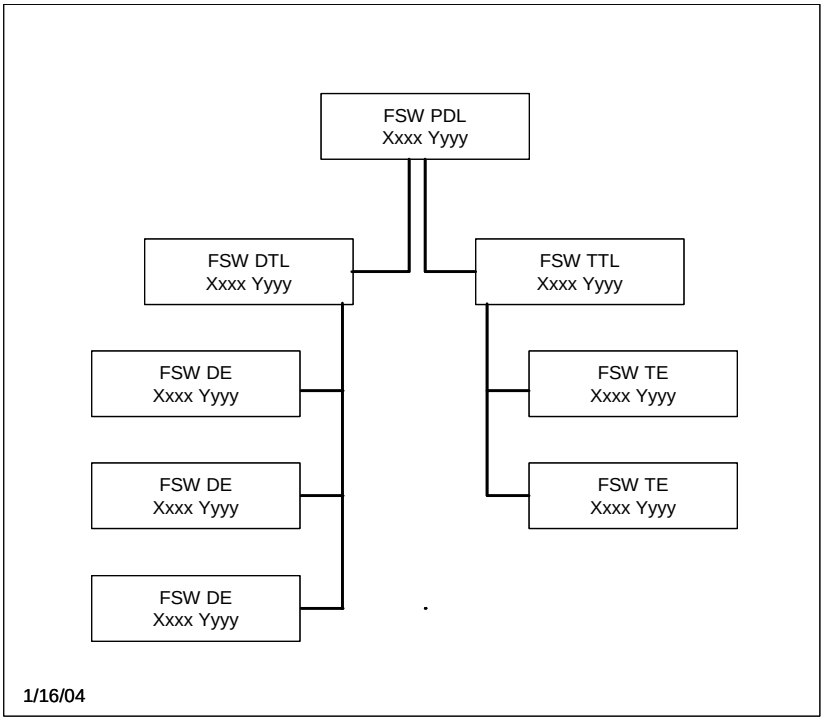
The FSW development team will develop, integrate, test, and deliver the [Mission Acronym] FSW, and all associated products, to support the mission. The team will support spacecraft integration, pre-launch checkout, launch, and early mission operations.

3.3.2 Team Organization Chart

The following chart shows the organization of the FSW development team:

[Include the Team org. chart here.

If some team members are dedicated test specialists, indicate that on the diagram as shown in this example:]



3.3.3 Team Scope

[A brief statement of the scope of the team's responsibility. If there are any limitations on the scope of the software to be developed (e.g., some portions will be developed by another organization), or on the team's length of involvement (e.g., up to Launch + 60 days) then state them here.

Replace or tailor the following statement:]

The FSW development team will acquire and/or develop all hardware and software necessary for [Mission Acronym] software development, except for those items, described in Section 2.8.1 (Receivables to FSW Branch), received from other organizations. The team will design, integrate, test and document all of the [Mission Acronym] FSW. The team will also provide maintenance support for the FSW from delivery to spacecraft I&T through on-orbit checkout.

[Unless a specific agreement has been made with the customer, include the following statement:]

The Branch will develop a Telemetry Monitoring and Response capability as part of the FSW. This capability will be fully validated to accommodate any mission-specific Fault Detection and Correction (FDC) requirements. However, the mission-specific data checks and stored commands or scripts associated with this capability are to be developed and tested by Project Systems Engineering personnel. As this represents a significant effort, it is important to note that it is not within the scope of the FSW development effort.

3.3.4 Roles, Responsibilities, Authority, Accountability

The roles assigned to PDT members are shown in Section 3.3.2. The responsibilities of each role are listed in the FSB Standard WBS (see Section 1.4, References) and, in greater detail, in the FSB Role Descriptions (see Section 1.4, References).

3.3.5 Decision Making and Conflict Resolution Process

[Describe who has input into the process of making design and implementation decisions (decisions affecting requirements are covered elsewhere). In the event of a conflict, who has the authority to make a final decision?

Replace or tailor the following statement:]

Design decisions related to the FSW will be made by all members of the development team. In the event of a conflict, the FSW lead will have final decision making authority. See Section 2.9 (Authority for Changes) for changes affecting cost, scope or schedule.

3.3.6 External Support

[Briefly describe the role of contractors, if appropriate. If some of the roles described in 3.3.4 are assigned to contractors, there is no need to repeat them here. If the reporting arrangements for contractors are not shown on the organization chart then they should be mentioned here.

Also include or tailor the following statement:]

Code 582, the Flight Software Branch, as the AETD provider of engineering support for this project, will provide organizational support for all aspects of the development effort. This support may include generalized development tools and development environments, documentation support, development computers, related training if available within the branch, temporary augmentation of resource levels as required for development, and support for internal reviews or audits.

3.3.7 Stakeholder Involvement

[Identify other organizations, teams, or groups necessary in developing, verifying, validating, or using the FSW. (NOTE: Customer stakeholders should be identified in Section 2.) Provide a matrix listing each stakeholder against the activities in which the stakeholder is involved. (See sample below.) Indicate whether the stakeholder's involvement is Required (R) or Optional (O).]

Section 2.4 described the involvement of the primary customer. Section 2.8 describes the deliverables to the PDT from other organizations. The following table shows the involvement of stakeholders other than the primary customer and organizations providing scheduled deliverables:

Activity	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1

Activity	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1	Stakeholder 1

Notes:

(1) I would really like to combine this section with Customer Involvement in Section 2. All of these commitment relationships need to be visible to, and signed off by, the customer. This would also make monitoring easier – all the content would be in one place.

3.3.8 StakeHolder Commitment

[Identify all stakeholders (other than the customer) from whom commitment to this SMP/PP must be obtained in order to perform or support the plan's execution. Describe both how the requests for stakeholder commitment and the commitment itself will be documented. A stakeholder's signature on the signature page of this SMP/PP is considered as evidence of commitment.]Notes: the tailoring advice above is directly from the ISD template. It's possible (I don't know for sure) that there are MOUs or something similar with IV&V and Code 300 that would work if they are not on the sign off page. I'd prefer some very specific boilerplate here, rather than the tailoring advice. See notes on previous paragraph also.

3.4 DEVELOPMENT FACILITIES

This Section describes the facilities to be used for FSW development, integration, and test. This Section describes only facilities – the development environment is described in Section 4.1.6.

3.4.1 Modifications of Existing Facilities

[If the development effort requires the modification of an existing facility, describe the modifications here. Also describe the schedule for completing the modifications. The schedule may be included by reference to another source, however, if there is a critical availability date beyond which there would be a schedule impact on this development effort, that should be clearly stated here.]

3.4.2 Development of New Facilities

[If the development effort requires the creation of a new facility, describe the new facility here. Also describe the schedule for completing the facility. The schedule may be included by reference to another source, however, if there is a critical availability date beyond which there would be a schedule impact on this development effort, that should be clearly stated here.]

3.4.3 Security

3.4.3.1 PHYSICAL SECURITY

[Describe how physical access is controlled to each of the facilities listed in 3.4]

3.4.3.2 ELECTRONIC SECURITY

[This section describes the IT infrastructure and functionality needed to create the FSW products.]

The [Mission Acronym] FSW Information Technology (IT) computer systems will comply with the policies and procedures of the Flight Software Branch, the Information Systems Center, GSFC and NASA.

This section of the Product plan will be reviewed by a 582 system administrator. A 582 system administrator will also perform a security scan on the hardware before connection to any network.

[Use the paragraph above or modify to indicate deviations/waivers from the policies.]

3.4.3.2.1 Infrastructure Description

[List each computer asset type and its functionality using the following example table:]

System Type	Number	Functionality
[Development host]	n	[Software Development and Testing]
[DCR host]	n	[Discrepancy Reporting System]
[file server]	n	[Document Repository System]
[CMS host]	n	[Configuration Management System]
desktop systems	n	Code and Document Generation, Email

3.4.3.2.2 Access

Access to the information and resources on each system will be appropriately restricted to only include those people who have a need to utilize it. Appropriate restrictions will be defined in consultation with system administrators and IT security staff. Flight software products, including source code and documentation will not be made available to the general public.

[List each computer asset and how you plan for its resources to be accessed. Include ftp, telnet, web-access, shared disks/folders, server and client software systems, etc., as in the following example:]

System Type	Method of Access
[Development host]	[ftp/telnet]
[DCR host]	[AAA Problem Tracker Software with Web Server Interface]
[file server]	[http / ftp]
[CMS host]	[AAA CM Server Software]
desktop systems	None

3.4.3.2.3 Risk Assessment

Two primary risks to the [Mission Acronym] FSW development effort from an IT infrastructure viewpoint are:

- Intrusion: unauthorized access to a system, leading to possible compromise of essential data.
- Physical Loss: destruction of the system due to disk failure, flood, fire, etc.

Every reasonable effort will be made to protect our systems from intrusion and physical loss. However, in the event of a security incident, the affected system(s) may be unavailable for two weeks or longer as the incident is investigated and repaired. For physically damaged systems, replacement may also take weeks to accomplish.

The flight software development effort does not reserve any cost or schedule contingencies in the event of a security incident or physical loss.

More minor, but potentially more likely risks include: extended power loss, HVAC maintenance etc. The table below specifies the levels of acceptable risk for our systems and the longest tolerable period of interruption at any point during the development effort.

[List the criticality (high, medium, low) for each of your systems and how long your project can function without the system. Remember that this downtime could occur at the worst possible time during your project.]

System Type	System Criticality	Allowable Period for Interruption of Service
[Development host]	[high]	[1 week]
[DCR host]	[medium]	[2 weeks]
[file server]	[low]	[4 weeks]
[CMS host]	[high]	[1 week]
desktop systems	[low]	[2 weeks]

3.4.3.2.4 Recovery Procedures

No recovery procedure is provided here for catastrophic loss of the [Mission Acronym] IT infrastructure. If, however, a single system is lost, the workload of that system will be transferred to other systems.

The following table shows which systems will take on additional workload in the event of loss in a single system.

System Type	Recovery System
[Development host]	
[DCR host]	

System Type	Recovery System
[file server]	
[CMS host]	
desktop systems	ODIN / Branch system

A Code 582 system administrator and the development team's privileged user(s) will perform system configuration and software restoration activities. The system administrators will also be responsible for conducting backups of each system. The frequency of the backups will not exceed the downtimes listed in 3.4.3.2.3. The process of recovering from backups will be exercised quarterly.

3.4.3.2.5 Responsible Personnel

[Get one of the sys admins to review this section before finalizing it. Privileged Users are skilled developers that can be trusted with root access and can work with the system administrator to implement this plan.]

Title/Role	Responsibility
System Administrator	System Administration System Security Recovery Backups System Configuration
Lab. Manager	Daily Administration Verify & Coordinate Effective System Administration Implementation of System Configuration and Security Compliance
CM Technician	Install, configure CM applications

3.5 PROCUREMENT

This section describes the purchases planned for the project.

3.5.1 Procurement Needs, Dates and Contracts

Contractor support will be obtained via the following contracts:

- NNG-05CA99C METS (SGT)
- NAS 5 01090 MSES (Swales)
- S 15700 IDIQ (CSC)

[Identify the contract number and task number(s) under which contractor support will be obtained.

The following table identifies the hardware, software, training, and services that will be procured to support the FSW development:

Item	Qty.	Date	Cost
Hardware item #1	1	mm/dd/yy	$2,200
Software item #1	2	mm/dd/yy	$752
Training	5	mm/dd/yy	$1,100
Miscellaneous	1	mm/dd/yy	$109
Total			**$4,161**

3.5.2 Reference Procurement Process

[Include or tailor the following statement:]

All procurements will be made using the approved Center-wide procurement processes in accordance with GPG 5100.1 (Procurement).

For procured items intended to be included in FSW, or to test FSW, the GSFC Receiving Inspection and Test System (RITS) will be used:

<http://rits.gsfc.nasa.gov/ritsindex.cfm>

3.6 TEAM TRAINING PLAN

The following table shows specific team training, how the training will be delivered (formal training class (C) or On-the-Job Training (OJT)), and when the training is required.

[

Do not remove any rows from this matrix – these items are required. In the “When” column specify when the training is required in a relative way, e.g., prior to coding, before the start of system integration, etc. Add rows as needed for additional items.]

[This matrix may be included by reference to an external spreadsheet or database in which these items can be tracked]

Team Role	Training	Class (C) or OJT	When?
All	Product Plan familiarity walkthrough	OTJ	
All	Test Plan familiarity walkthrough	OTJ	
All	Configuration Management Plan familiarity walkthrough	OTJ	
All	ESD training	C	
All	Configuration Management Tool (MKS Source Integrity) familiarity	C / OTJ	

All	Discrepancy Reporting System (MKS Integrity Manager) familiarity	C / OTJ	
All	Requirements Management System (Rational Requisite Pro) familarity	C / OTJ	
Test Team	Test Status Tracking (Rational Requisite Pro.)	OTJ	

In addition to the tool and product training described above, each team member will have already received OJT in their team role on a prior project, or will receive role-based OJT from a mentor while on this project. The following table shows the role-based training plan for this project:

Name	Role	Qualified?	Qualifying Missions	Mentor (this mission)	Mentor Role
Person A	PDL			Person X Person Y	SM ABH
Person B	DTL (C&DH)	Y	XTE, MAP		
Person C	DE (C&DH)	Y	MAP		
Person D	DE (C&DH)	Y	XTE		
Person E	DE (C&DH)			Person B	DTL (C&DH)
Person F	DE (C&DH)	Y	Triana		
Person G	DE (C&DH)	Y	Triana		
Person H	DTL (ACS)	Y	XTE		
Person I	DE (ACS)	Y	XTE		
Person J	DE (ACS)	Y	XTE		
Person K	TTL	Y	XTE		
Person L	TE	Y	XTE		
Person M	TE	Y	XTE		
Person N	TE			Person K	TTL
Person O	TE	Y	XTE		
Person P	STE (Sims)	Y	MAP, Triana		
Person Q	STE (CM/Tools)	Y	MAP, Triana		
Person R	LM	Y	MAP, Triana		

Notes:

- Name = team member name
- Role = role on this team
- Qualified = Y if team member has been certified in the role on a previous mission
- Qualifying Missions = name(s) of the previous mission(s) on which the team member was certified (certifications are on file with the Branch)

- Mentor = name of team member (and/or Branch Management) providing role mentorship on this mission
- Mentor Role = role of team member (and/or Branch Management) providing role mentorship on this mission

3.7 RISK MANAGEMENT

[Include the following section without modification, unless there are any external constraints such as the requirement to record risks in a Project risk management database in addition to the FSW Branch database.]

3.7.1 Initial Risk Assessment

Initial risk assessment has been performed by the PDL and is provided in this Section. All risks that have a credible possibility of impacting the timely delivery of high quality FSW products to I&T have been identified.

[Include an overview of the risks identified, with mitigation approaches if known. The details will be contained in the FSW Branch database.]

This information has been recorded in the FSW Branch Risk Management System:

http://fsw.gsfc.nasa.gov/internal/RM/

and also, as appropriate, in the Project's Continuous Risk Management (CRM) System.

3.7.2 Risk Tracking and Review

After the initial risk assessment described above, risks will be continually monitored and re-assessed throughout the development effort. For each risk identified, the PDL will assess and record the following information:

- the probability of occurrence of the risk (chosen from a pull-down list)
- the severity of the impact, if the risk occurs (chosen from a pull-down list)
- the timescale for available mitigation actions (chosen from a pull-down list)
- the source of the risk (chosen from a pull-down list)
- the category of the risk (chosen from a pull-down list)
- the name of the team member responsible for tracking the risk to retirement
- the steps of a mitigation plan for the risk (if mitigation steps are available)
- the steps of a contingency plan for the risk (if contingency steps are available)
- the current state of the risk (chosen from a pull-down list)

The PDL may update the risk database at any time, for any of the following reasons:

- a new risk is identified

- the status of an existing risk changes

Risk status will also be reviewed on the following specific occasions:

- FSW Life-cycle Reviews:
  - overall risk summary
  - current status of high exposure risks
- FSW Branch internal status reviews (monthly):
  - overall risk summary
  - current status of high exposure risks
- Development team meetings:
  - new risks identified
  - brief review of identified risks, to determine any change of status

Any new risks, or changes to existing risks, will be recorded in the risk database as described above.

3.8 SCHEDULES

[Include an end-to-end software development schedule showing major milestones and deliveries.

The detailed software development schedule does not need to be shown here – it is usually too large and subject to change. If it is available on-line, include the reference here.

For this section, include a high-level overview schedule showing at least the following events:

- Major project milestones:
  - Spacecraft reviews
  - Major I&T milestones
  - Ship date
  - Launch
- Major FSW milestones:
  - FSW reviews
  - Document deliveries (draft and final Product Plan, Test Plan, CM Plan)

- FSW Deliveries
- Major FSW testbed milestones:
  - special hardware
  - simulators
  - ground system

]

3.9 LIST OF CONTROLLED DOCUMENTATION

[List all documents that will be developed and placed under Project or Team configuration management during the development effort. Include or tailor the following table:]

Some documents produced during development will be formally placed under the Project's configuration management after approval. Others will be configuration managed by the development team. The following table shows the breakdown (note that this table refers to documents, not to code):

Documents under Project CM	Documents under Team CM
• FSW Product plan (this document) • FSW Requirements Document • FSW Interface Control Documents (ICDs) • FSW Configuration Management Plan • FSW Test Plan • FSW Telemetry Definitions Document • FSW Command Definitions Document • [Add others as needed]	• Quality Records List (see Section 5.2.3) • [Add others as needed]

3.10 PROCESS & PRODUCT METRIC ANALYSIS

There are two types of metrics that can be measured during the development effort:

- metrics that measure the development **process** ("process metrics") such as schedule milestones achieved, budget performance, or the number of units that have passed unit test,

- metrics that measure the developed **product** itself ("product metrics") such as the amount of memory occupied by the executable code, percentage of available CPU time used, or the number of discrepancy reports received to date.

This section describes the process(es) for gathering and analyzing these two types of metrics.

The measurement objectives for this effort have been identified based on the information needs and goals of the development team and the Flight Software Branch. Measurements will be taken in the following areas:

- Software progress and cost tracking
- Software functionality
- Software quality
- Software requirements volatility
- Software characteristics

[In addition, projects that are required to be CMMI Level 2 must collect and analyze process measures for each of seven process areas: Project Planning, Project Monitoring and Control, Configuration Management, Requirements Management, Process and Product Quality Assurance, Measurement and Analysis, Verification, and Validation.]

The measurement areas, objectives, analysis and measures are shown in the following table:

Measurement Area	Measurement Objective	Analysis	Measure(s) (Asterisk (*) indicates measure is required by the ISD Measurement Program.)
Software progress and cost tracking	Ensure project schedule is within 10% of the planned schedule.	Compare planned vs. actual schedule; analyze deviations.	*Event dates (planned and actual) (NOTE: Collect both milestone dates and process event dates.)
	Ensure product progress is within 10% of planned progress.	Compare planned progress points vs. actual progress points.	*Progress tracking points (planned and actual)
	Ensure project effort and costs remain within 10% of budget.	Compare planned vs. actual effort.	*Total Effort (planned and actual FTEs for civil servants and contractors)
		Compare planned vs. actual costs.	Facility and equipment costs (planned and actual)
Software functionality	Deliver the required software functionality.	Compare planned vs. delivered by release or build.	Number of requirements in the release/build (planned and delivered)
	Ensure performance measures are within margins.	Compare critical performance measures against margins.	Memory utilization by CSCI (planned and actual)
Software quality	Ensure product quality.	Compare expected vs. actual level of defects.	*Number of DCRs by severity (critical, moderate, minor)
		Analyze responsiveness to detected defects.	Open and closed DCRs by severity
		Analyze responsiveness to action items.	Open and closed RFAs
Software requirements volatility	Control requirements volatility.	Compare actual to expected level of requirements changes.	*Total number of (actual) requirements changes (i.e., sum of additions, changes, and deletions) Requirements changes by CSCI

Measurement Area	Measurement Objective	Analysis	Measure(s) (Asterisk (*) indicates measure is required by the ISD Measurement Program.)
		Compare actual to expected level of requirements TBDs.	*Total number of (actual) requirements TBDs Requirements TBDs by CSCI
Project Planning	Ensure project is re-planned if current estimates exceed planning parameters by 20%.	Re-estimate planning parameters and compare to current estimates.	*Original and revised planning parameters (cost, effort, schedule, local size measure) by revision Number of revisions to plan
Project Monitoring and Control	Ensure necessary project activities are performed.	Analyze responsiveness to action items	Number of open vs. closed action items
	Ensure project schedules are met.	Analyze occurrences and trend.	Milestone dates met vs. missed
	Ensure project risks are monitored and controlled.	Analyze changes to risk parameters and priorities.	Number of added, modified, and retired risks by severity
Configuration Management	Ensure configuration management is being performed as planned.	Compare number of changes to expected levels.	Number of changes to configured items (same as Number of DCRs by severity (critical, moderate, minor)
		Compare planned vs. actual effort.	Effort expended in configuration management (planned and actual)
Requirements Management	Ensure requirements are being managed as planned.	Compare requirements changes to expected levels.	Number of additions, changes, deletions to requirements by CSCI (same as Requirements Volatility)
Process and Product Quality Assurance	Ensure software assurance is being performed as planned.	Compare planned vs. actual evaluations.	Number of evaluations (planned and actual)
Measurement and Analysis	Ensure project measures are collected and analyzed as planned.	(as listed in this table)	(as listed in this table)
Verification	Ensure verification activities are performed as planned.	Compare planned vs. actual numbers of peer reviews.	Number of peer reviews (planned and performed)
		Compare actual vs. planned effort on peer reviews.	Time spent on peer reviews (preparation and review)
		Compare numbers of defects found to expected levels.	Number of defects found (in peer reviews) by type
Validation	Ensure validation activities are performed as planned.	Compare number of planned vs. completed validation events.	Number of validation events (planned and completed)

Measurement Area	Measurement Objective	Analysis	Measure(s) (Asterisk (*) indicates measure is required by the ISD Measurement Program.)
Software characteristics	Support ISD model-building for future process improvement.	(None required at the project level.)	*Software project name *Software type (flight, ground, analysis/research, infrastructure, other) For each CSCI: *CSCI name *Primary language (e.g., C, C++) *COTS/GOTS/MOTS products *Size (final) *Units (in which size is measured)

These measures will be reported in the Branch Status Report. The process for collecting, analyzing, and archiving these measures is described in the FSB Measurement Plan (see Section 1.4, References).

[Note: we still haven't determined whether there will be a separate Measurement Plan, or we specify everything here. We'll come up with a working approach as we do the SDO Product Plan update, then retro-fit that approach to this template]

3.11 WORK BREAKDOWN STRUCTURE

The [Mission Acronym] Project Work Breakdown Structure (WBS) includes FSW as one (or more) element(s). However, for its own internal use in breaking down the FSW development effort into manageable units, for estimation and resource tracking, the team will use the FSB Development Work Breakdown Structure (see References).

Figure 3.11-1 shows a diagrammatic overview of the FSB Development WBS:

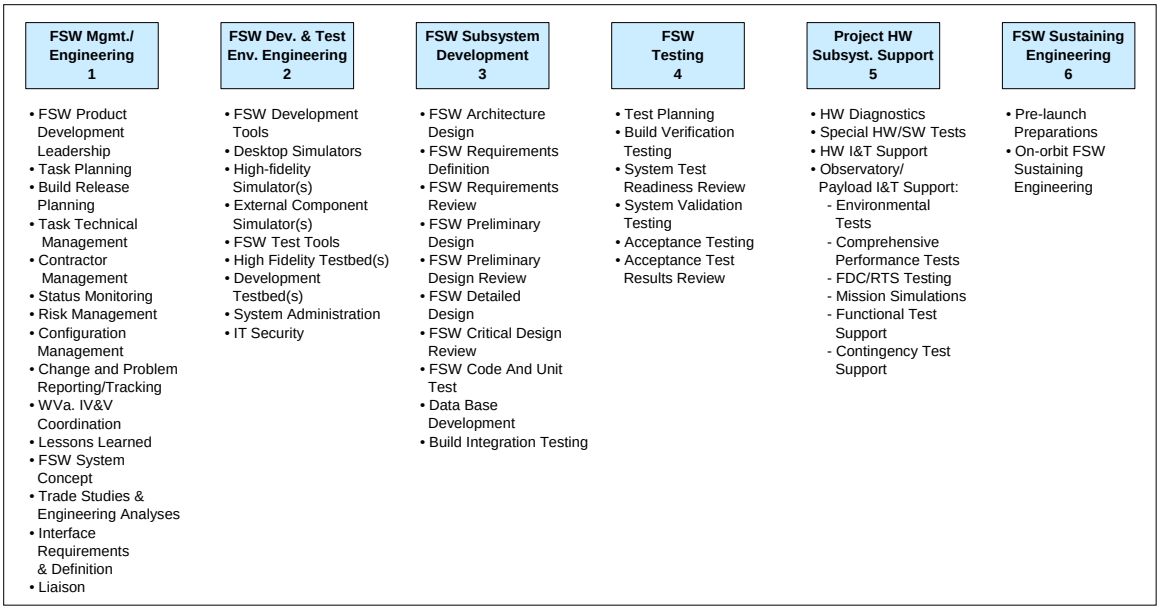


Figure 3.11-1 FSB Development Work Breakdown Structure

The FSB Standard WBS (see Section 1.4, References) includes additional useful information such as a more detailed breakdown of activities mapped to the team role having primary or support responsibility.

3.12 SOFTWARE SAFETY

The PDL will analyze the proposed software to determine which elements are safety critical. For the software elements determined to be safety critical, the PDL will work with Code 300 to develop and implement a tailored set of appropriate development and QA activities.

3.13 STATUS TRACKING

Throughout the development of the [Mission Acronym] Flight Software, status will be tracked using the measures described in Section 3.10 (Process & Product Metric Analysis), and additional non-numeric status information, such as the status and history of issues, etc.

Status information will be analyzed by the PDL and DTLs, for inclusion in the Branch monthly status review, and presented to FSB Management. A subset of the monthly review material will also be presented to the Project.

Softcopies of the monthly review presentation and data spreadsheet will be archived in the PDT repository.

The contents of the monthly status review are defined in the “FSW Status Reporting Template – PDL” (see Section 1.4, References).

4.0 TECHNICAL APPROACH

This Section describes the technical approach for developing, delivering, and maintaining the FSW.

4.1 SOFTWARE DEVELOPMENT PLAN

This Section describes the technical approach for developing the FSW.

4.1.1 Life-cycle

The following Figure shows the typical FSW development life-cycle for in-house missions. The number of builds varies by project, but the relative phasing of builds, FSW reviews, and major spacecraft events should be as shown:

[Note any significant deviations from this diagram, such as different terminology, etc.]

[Note that the life-cycle diagram included in this template is current at the time of writing of this template. Before finalizing a Project-specific Product plan, check the following address for the latest version of this diagram:

<http://fsw.gsfc.nasa.gov/internal/StandardsCCB/>

]

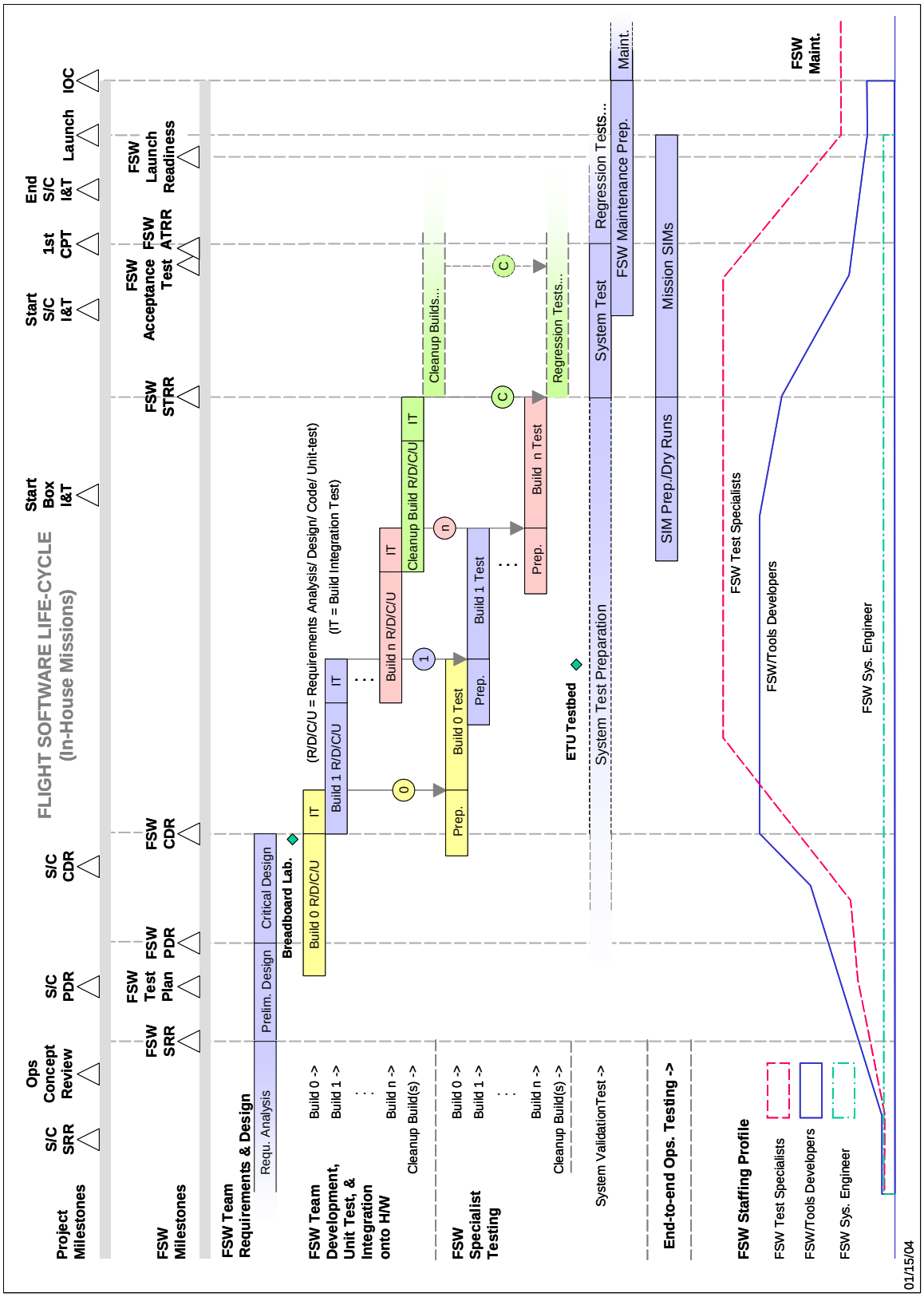


Figure 4.1.1-1 Flight Software Life-Cycle for In-House Missions

4.1.2 Phases and associated products

The following table lists the life-cycle phases, with development activities and products associated with each phase:

[Tailor the table as necessary.

If development phases are combined (e.g., SRR and PDR may be combined on small projects) ensure that all development activities and products from both phases are covered under the combined phase.

Normally, an internal Branch peer review will be held before each formal review. The peer review may be combined with the formal review on small or high re-use projects.

Phase	Development Activity
Concept Definition	The developers work with the customer to understand the mission concept and requirements. The developers use their FSW experience to guide the customer in making trades affecting (or affected by) FSW, such as the choice of flight CPU. The initial FSW re-use strategy is defined. Typically, a heritage FSW architecture is selected.
Products	• FSW Product plan (draft) • FSW conceptual design • FSW Work Breakdown Structure (WBS) (draft)
Exit Criteria	The end-of-phase review is a Branch FSW Concept peer review.
Requirements Definition	[sometimes combined with the next phase] The developers work closely with the customer to understand and document the software requirements for the FSW (functional and performance requirements). The requirements are reviewed for clarity, completeness and testability. A requirements traceability matrix is produced, showing how the Mission requirements flow down to FSW requirements.
Products	• FSW Requirements Document • SRR Presentation Package • Mission requirements to FSW requirements traceability matrix
Exit Criteria	• Branch FSW Requirements peer review held • SRR completed • SRR RIDs answered • Requirements and specifications baselined The end-of-phase review is the Software Requirements Review (SRR).
Preliminary Design	[sometimes combined with the previous phase] Working from the FSW requirements and conceptual design, requirements are allocated to major subsystems. All internal and external interfaces are defined to the subsystem level. Designs of high-level functions or objects are specified. FSW components and units for re-use are identified. Walkthroughs are held for the emerging designs. The developers support the FSW maintenance team in producing a draft of the Independent Acceptance Test Plan.

Phase	Development Activity
Products	• PDR Presentation Package
Exit Criteria	• Branch FSW preliminary design peer review completed • PDR completed (typically, combined SRR/PDR) • PDR RIDs answered The end-of-phase review is the FSW Preliminary Design Review (PDR).
Detailed Design	The development team extends the software architecture down to the unit level. By successive refinement they elaborate the design to produce “code-to” specifications for each unit. Walkthroughs are held for the emerging designs.
Products	• CDR Presentation Package • Build-Test Plan
Exit Criteria	• Branch FSW critical design peer review held • CDR completed • CDR RIDs answered The end-of-phase review is the FSW Critical Design Review (CDR).
Coding	The developers code new units from the design specifications according to Branch standards, and perform any required modifications to re-used units. Team walkthroughs are held for each new or modified unit according to Branch standards. Periodically, units are aggregated into larger components and tested at the component level using simulators.
Products	• Units ready for unit testing
Unit Test	New and modified units are unit tested according to Branch standards.
Objectives	• Verify that each logical path of flight code meets all requirements for that logic. Verify nominal, error situations, and meaningful data cases. • Verify that each logical path of tightly coupled units performs properly when integrated and exercised together (integrated unit tests).
Environment	• The unit level tests will be conducted in the developers desktop environment. • Units that interface directly with flight hardware will be unit tested in the FSW testbed.
Responsibilities	**Development Team:** • Write unit test plans • Conduct code and unit test walkthroughs • Develop unit level test procedures with expected results • Develop data input configuration • Exercise all critical paths and logic of each unit • Produce and retain all unit level test products including unit test report

Phase	Development Activity
Entry Criteria (for each unit)	• Unit test plan for the unit is complete • Code and test plan walkthrough is complete • FSW unit development is complete

Products	• Unit level test drivers
	• For each unit:
	  o Unit Test Plan
	  o Unit Level Test Data (input/output captured)
	  o Unit Level Test Report
	• Unit Development Folders

Exit Criteria (for each build)	• Unit test of each unit for a specified FSW build has been successfully executed in accordance with the responsible developer's unit test plan. • All Unit Test Reports for the build have been submitted to the development lead and approved.
Build Integration Test	The developers integrate all FSW components into a build. They define and develop the ground database for the build. They load and execute the FSW in the target (flight-like) environment. This test verifies that the build is ready to begin Build Testing
Objectives	• Verify all major build functions • Verify that real-time commands implemented in this build result in the intended operation· Verify that telemetry output is correct • Verify that all modes of the software execute as expected • Verify all transitions between modes • Verify the interfaces to hardware, other software, and test equipment • Verify that new build does not interfere with previous build capabilities
Environment	The build integration tests will be conducted in the [list appropriate facilities]
Responsibilities	**Development Team:** • Plan and document the Build Integration Test Procedures • Integrate the software into a flight load • Load the software onto the hardware • Develop ground command and telemetry database for this build • Develop page displays for this build • Execute the build integration test procedures • Fix problems discovered during build integration test • Generate DCR's for problems discovered that will not be fixed as part of this delivery to the Build Verification Test team • Collect, analyze, and archive all build integration test results • Write the Build Integration Version Description document

Phase	Development Activity
Entry Criteria (for each Build)	• All units to be included in this build are complete and unit tested • Command and telemetry database definitions complete • Page definitions complete • Requirements implemented in this build are stable and identified to the Build Verification Team • CM and DCR systems are available • Build Test environment is available and functional· Build Plan is complete
Products	• Build Integration Version Description Document including: o FSW requirements allocated to this build delivery o FSW DCR's that remain unfixed by this build delivery o DCR's to FSW requirements. & ICD's associated with this delivery • Configured flight database • Configured ground database • Documentation of processor(s) load procedure • Modification history of changes to GSE • Build Integration Test Procedures • Build Integration Test Results • Image of the Build· Memory Map • Build Integration Test Plan • Build Integration Test Report
Exit Criteria (for each Build)	• Each Build Integration test has been successfully executed in accordance with the approved Build Integration Test Procedures on the Build Verification FSW testbed • All Build Integration Test Results data have been analyzed and archived. • The integrated build has been entered into the FSW Configuration Control system
Build Verification Test	
Objectives	• Certify the implementation of each requirement in the FSW requirements documents listed in Section 1.4 • Certify the implementation of each FSW command and its parameters • Certify all FSW telemetry • Certify all FSW event messages • Certify all FSW system tables
Environment	The Build Verification Tests will be conducted in the [list appropriate facilities]

Phase	Development Activity
Responsibilities	**Test Team** • Implement the Build Verification Test program according to the Test Plan **Development Team** • Deliver the FSW Build Plan identifying which requirements will be implemented in each build • Deliver the following for each build: o Build Integration Version Description Document o Build Integration Test Results o Executable image of the Build Integration Tested FSW o Configured flight database **Subsystem Analysts** • Review FSW Build Verification Test scenarios, procedures, and results
Entry Criteria (for each Build)	• Approved/Configured Requirements • FSW Build Plan • Updated Build Verification Test RTM and Test Description Document • Completed, peer-reviewed Build Verification Test Scenarios • Configured FSW Build Test Environment • Integrated FSW Build Software and Executable under formal CM • Build Integration Version Description Document • Configured flight database • Required FSW Development and Test Tools • Completed, peer-reviewed, debugged test procedures to implement test scenarios • Testbed training for Test Engineers • Testbed documentation (e.g. Users' Guides)
Products	• Archived Electronic Build Verification Test Output • Archived Build Verification Test Procedures • Archived Command and Telemetry Data Base (Verified) • Archived Page Display Definitions • Updated Build Verification Test Description Document and RTM • Build Verification Test Results Packages • Discrepancy Change Reports (DCR's) generated during Build Verification Testing • Build Verification Test Report
Exit Criteria (for each Build)	• All Build Level Tests for this build, or equivalent developmental increment, have been executed. • All build test results have been analyzed, approved, and archived • DCR's have been submitted for all problems detected by the build test team • The Build Verification Test report has been submitted by the FSW Test Lead and approved by the FSW Systems Engineer

Phase	Development Activity
System Validation Test	FSW System Testing occurs in parallel with other implementation phases (see life-cycle diagram). FSW System Testing dry runs begin with the first build having sufficient functionality to support closed-loop testing. FSW System Tests are formal end-to-end system tests, with the FSW configured as for operations, fully integrated on flight-like hardware:
Objectives	• Demonstrate that the flight software can support all operational phases of the mission • Demonstrate that the flight software can detect anomalies and failures and initiate the appropriate response (e.g., Safehold) such that no mission or orbital event can damage the spacecraft. • Demonstrate that the flight software can perform under fully stressed closed-loop operational conditions.
Environment	System Validation and Acceptance Testing is conducted in the [list appropriate facilities]
Responsibilities	**Test Team** • Implement the System Validation Test program according to the Test Plan **Development Team** • Provide flight software expertise as required during testing • Fix DCR's • Provide cleanup builds with corrections DCR corrections **Subsystem Analysts** • Review FSW System Validation Test scenarios, procedures, and results
Entry Criteria	• Completed Build Verification Testing for All FSW Elements • Working/Certified FLATSAT facility • FLATSAT training for Test Engineers • FLATSAT documentation (e.g. Users' Guides) • Validated Command and Telemetry Databases • Required FSW Development and Test Tools • Completed System Validation Test RTM and Test Description Document· • Completed, Peer-Reviewed System Validation Test Scenarios • Completed, Peer-Reviewed, and Debugged Test Procedures To Implement Test Scenarios • Most Up-to-Date FSW Table Values • Preliminary TSM Tables as Provided by System Engineering • System Test Readiness Review completed
Products	• List of DCR's • Final System Validation Test RTM and Test Description Document • Archived electronic test output for each System Validation Test • System Validation Tested FSW • Final System Validation Test Procedures • System Validation Test Results package for each Test • System Validation Test Report

Phase	Development Activity
Exit Criteria	• All defects that must be corrected prior to Comprehensive Performance Test have been identified, corrected, and retested • All System Validation Tests have been successfully executed in accordance with the approved test procedures. • DCR's have been submitted for all problems detected by the System Validation Test team • The FSW System Validation Test Report has been submitted and approved. • Acceptance Test Results Review completed
Spacecraft Integration & Test (I&T) Support **Products**	The development team provides technical support as required during spacecraft I&T. • Spacecraft I&T support as needed • FSW User's Guide (Update)
Operations Support **Products**	The development team provides technical support as required during spacecraft on-orbit checkout. • Support for on-orbit operations and FSW maintenance team.

4.1.3 Development Status

The following methods will be used to track and report development status throughout the FSW life-cycle:

- Module status checklists
- Test status matrices
- Configuration management status reports
- Status reports/statistics from the Discrepancy or Change Reporting system
- Point counting reports (see Section 1.4, References)
- FSW Status Reporting Spreadsheet – PDL (see Section 1.4, References)

[Additional methods may be used at the discretion of the team lead(s) – add them to this list]

4.1.4 Development Journals

Throughout the development life-cycle, the PDL will maintain the following logs, for reference during the project, and for eventual archival by the Branch:

- Team Lessons-Learned
    - A list of lessons-learned, noted as they occur

    - At the end of the development effort, a lessons-learned report containing the accumulated lessons, together with any recommendations to be applied to future development efforts.

- Key Issues and Decisions

    - A list of important issues, with resolution and rationale, noted as they occur, tracked to closure

[Specify where these logs will be kept. An electronic archive (such as a web site or database) accessible to team members and Branch management is the preferred method.]

4.1.5 Methodology

[Describe the methodologies to be employed during the development process, addressing all phases of the life-cycle through implementation. The following questions should be answered:

- What is the requirements analysis methodology (structured, Object Oriented (OO), other)?
- How will the requirements be represented in the Requirements Document (plain text, Data Flow Diagrams (DFDs), OO diagrams, other)?
- Will the requirements be maintained in a database or automated tool?
- What is the design methodology (functional decomposition, Object Oriented Design (OOD), other)?
- How will the design be represented in the design reviews (structure charts, OO design charts, other)?
- Will an automated tool be used to prepare/maintain the design diagrams?
- Will prologs and Program Design Language (PDL) be part of the output from the design process?
- Is there an intention to re-use software, if so:
    - How much re-use is intended?
    - What is the source for re-usable software (previous project, Code 582 Software Library, other)?
    - Will developed or modified software components be added to the Code 582 Software Library?
- Is there an intention to use COTS/GOTS software (leave the details to Section 4.1.2.4)?
- Is there an intention to perform rapid prototyping activities, if so:
    - Why (risk reduction, other)?
    - Which specific questions will be answered by the prototyping activity?
    - Will the prototype(s) be discarded or form part of the final FSW?
- Has an implementation language been selected, if so, what drove the selection (desire for code re-use, tool availability constraint, personnel experience, performance constraint, other)?

- Will the FSW be developed/released in builds (leave the details to Section 4.1.2.5)?

]

4.1.6 Development and Test Environment

[The development facilities were described in a high-level way in Section 3.5. This section contains details of the actual development and test environment. Describe the following:

- Target CPU
- Target Real-Time Operating System (RTOS)
- Testbed environment(s)
- Host machine for requirements/design activities:
  - What is the host (remote mainframe, desktop computer, workstation)?
  - How many are there (one, one per developer, etc.)?
  - Which software tools are available to support requirements/design activities (be specific)
- Host machine for implementation/unit-test activities:
  - Same as requirements/design host?
  - How many are there (one, one per developer, etc.)?
  - Which software tools are available to support implementation/unit-test activities (be specific):
    - Compiler/linker
    - Configuration Management System (CMS)
    - Test tools
    - CPU emulator (if development CPU different from target CPU)
    - File backup/restore

Typically, the development environment may contain several different environments in which FSW can be developed and, possibly, more than one execution environment. Describing these verbally can be complex and confusing. Consider using a table such as the example below from SDO:]

Element	Description
Target CPU:	SBC -> PPC; SDN -> ColdFire RH-5208
Target Real-Time Operating System (RTOS):	SBC -> VxWorks; SDN -> RTEMS
Testbed environments:	

Element	Description
C&DH String:	BB SBC, BB-SCOMM, FEDS, RT Simulator
ACS/ACE String:	BB SBC, BB-ACE, BB-GCE, GDS, S-Comm Simulator
Flatsat:	ETUs of C&DH, PSE (one side), ACE, GCE, SCOMM
Host for requirements/design activities:	Desktop PCs
Tool suite for requirements/design activities:	None
Host for implementation/unit-test activities:	Desktop PCs
Tool suite for implementation/unit-test activities:	Flight code -> gnu C compiler Unit test -> MS Visual C++, Borland C++
CM/DR host system:	File server
CM/DR tool:	TBD (November '03)

It is also important to include a block diagram of the testbed environment, showing the major elements and how they are interconnected. **Any FSW requirements that cannot be adequately tested in this environment should be explicitly listed here. These (if they exist) will represent major items of risk – mitigation strategies should be described in Section 3.7 (Risk Management).**

4.1.7 Standards

[Specify any standards that will be used during FSW development. Examples include:

- FSW Branch Documentation Standard
- FSW Branch Coding Standard
- FSW Branch Unit Test Standard
- CCSDS standards for command and telemetry
- Any commercial standards used
- Any customer-imposed standards

Add the standard names to the list of reference documents in Section 1.5]

4.1.8 COTS/GOTS Products and Tools

[Specify any COTS/GOTS products that will be used to develop and test the FSW, or that will be incorporated into the final FSW:

Tool/Product	Description
Requirements management tool(s):	N/A
Design tool(s):	N/A

Tool/Product	Description
Configuration management tool(s):	TBD
Discrepancy reporting tool(s):	TBD
Metrics tool(s):	TBD
Static code analysis tool(s):	LINT
Dynamic code analysis tool(s):	Wind River Tornado
Debug tool(s):	Wind River Tornado
Compiler(s):	GNU C Compiler
COTS autocode tool(s):	MATLAB,/SIMULINK
Unit test tool(s):	Visual C++, Unified Test Framework (UTF)
Integration test support tool(s):	N/A
System test support tool(s):	N/A
Test data analysis tool(s):	N/A
RTOS:	Wind River VxWorks, RTEMS
Function libraries:	N/A
FSW Branch re-use library products:	Ephemeris code, ACS libraries

[If open source software or commercial, government, or modified off-the-shelf software (COTS, GOTS, MOTS) is to be incorporated in the delivered software system, identify any approvals required for proprietary, usage, ownership, warranty, and licensing rights. Open source software licenses should be reviewed by the Center Chief of Patent/Intellectual Property Counsel before being accepted into software development projects. Identify any other regulated approvals or required certifications for system components.]

4.1.9 FSW Build Strategy

[If the system will be developed in builds and/or releases, the build/release plan should be described here. Specify the name (or number) of each build/release, and list the major functions to be included in each. Annotate any functions that have the same name but substantially different content between builds/releases (e.g., a low performance prototype function in Build 1 is replaced by a high performance final version in Build 3)

The example below shows an example of minimal description of the build strategy:]

Development Build	Included Functionality
Build 0	Data Processing Models task (solar, lunar, orbit) Telemetry and commands required to support the above
Build 1	Attitude Determination Control Processor (Modes) Telemetry and commands required to support above Table processing

Development Build	Included Functionality
Build 2	Failure Detection & Handling (FDH) Any required bug fixes

4.1.10 FSW Inspection and Test Approach

This section describes the approach to ensuring FSW quality through inspection, test, and reviews.

[Replace or tailor the following:]

The following list summarizes the inspection and test methodology, and terminology:

Requirements Reviews:

- Performed through inspection by the FSW test team and the development team, results are incorporated into the requirements and baselined for external reviews.
- Performed through peer and formal review at the PDR/SRR.
- RFAs at PDR/SRR are recorded and answered by the FSW development team

Design Reviews:

- Performed through informal discussions and reviews by the development team, results are incorporated into existing design and baselined for external reviews
- Performed through peer and formal Review at the PDR/SRR.
- RFAs at PDR/SRR are recorded and answered by the FSW development team
- Performed through peer and formal review at the CDR.
- RFAs at CDR are recorded and answered by the FSW development team

Source Code Inspections:

- Rigorous and formalized inspection of source codes, prior to unit test
- Results are documented and retained by the development team
- Action items are tracked to closure

Unit Testing:

- Tests usually exercise one function at a time
- Valid and invalid inputs are tested (including single and multiple errors)
- Error conditions are established and error handling/recovery is verified

- Branch Testing is performed (path testing, where feasible)
- Designed and performed by programmer on development workstation and target
- Results reviewed by team at code walkthrough
- Unit Testing is conducted in compliance with the Code 582, Branch Standard for Unit Test.

Hi-Fidelity Simulator Comparison Testing (ACS Only):

- Used to verify ACS code - algorithm fidelity
- Performed in conjunction with unit test.
- Designed by programmer and analyst who supplied the algorithm
- Performed by programmer on development workstation
- Results compared to analyst ("hi-fidelity") simulation outputs and reviewed by analysis team

Build Integration Testing:

- Verifies apparent functionality of the integrated build before release to test team
- Test conducted in the embedded environment with appropriate real-time simulators, and the same ground system to be used in build testing
- Sending all build commands and verifying in telemetry
- Executing all modes of the software & verifying all transitions between modes
- Executing major build functions (e.g. Kalman filter, Data Storage)
- Test procedures designed and executed by software developer
- Errors are corrected at the discretion of the PDL - any errors carried forward are documented and noted in the Version Description Document (VDD) accompanying the delivery to the build test team

Build Testing:

- Verifies that the flight software build operates as designed and that all functional and performance requirements have been met
- Test procedures designed and executed by the FSW test team
- Tests based on functional and performance requirements allocated to the build
- Results published in the Build Test Report

Dynamic Simulator Testing (ACS Only):

- Closed- loop testing of attitude determination and control laws

- Dynamic simulator used to model S/ C dynamics and hardware
- Performed in conjunction with Build Testing, but specific to ACS Flight Software

FSW System Testing:

- Fully integrated software
- Configured as to be used operationally
- Executed on flight-like hardware
- Test procedures designed by independent test team, according to System Test Plan and requirements documents
- System Test scenarios focus on operational capabilities of the system (both nominal and anomalous flight conditions)
- Acceptance Test is the ending event of the System Test phase – execution of all System Tests on the final FSW build
- System Test Readiness Review validates that FSW is ready for System Test
- Acceptance Test validates FSW is ready for CPT
- Acceptance Test results reviewed at the Acceptance Test Results Review

The table in Section 4.1.2 (Phases and Associated Products) shows development activities taking place in each life-cycle phase. This table also lists inspection and test activities by phase.

[Add any additional mission-specific inspection and test information here:]

4.1.11 Acceptance Criteria and Objectives

[Include the paragraph below – tailor as necessary]

Acceptance criteria and objectives will be documented in the FSW Test Plan.

The requirements traceability matrix used in development team testing will not be used in acceptance testing.

4.1.12 Reviews Planned

The FSW PDL, in conjunction with the Branch, will select a review panel for each review. Review panel members will be selected based on their experience relative to the particular review. For SRR, PDR, and CDR, the review panel should include members who are independent of the PDT, the Project, and FSB management. The role of the review panel is to manage the flow of the review, and to ensure that Requests for Action (RFAs) are collected and tracked to completion. The following reviews are planned:

[Include the following table, tailoring as necessary:]

Review	Participants	Content

SRR
[sometimes combined with PDR]
	• Review Panel
	• Customer Representatives
	• Developers
	• Test Team
	• CCB
	• Selected FSW Branch specialists
		• SRR Presentation Package:
		  • Schedule & Staffing
		  • Relevant Mission Characteristics
		  • Operations Concept Overview
		  • Functional Requirements Summary
		  • Interface Requirements
		  • Performance Requirements
		  • FSW Qualification Requirements
		  • FSW Re-use Strategy
		  • Requirements Control Approach
		  • Issues, Risks, TBDs, Actions

PDR
[sometimes combined with SRR]
	• Review Panel
	• Customer Representatives
	• Developers
	• Test Team
	• CCB
	• Selected FSW Branch specialists
		• PDR Presentation Package:
		  • Updated Schedule & Staffing
		  • Requirements Overview
		  • Design Overview
		  • Operations Scenarios
		  • Major Software Components
		  • FSW Re-use Candidates
		  • Requirements Traceability Matrix
		  • Testing Strategy
		  • Design Team Assessment
		  • Estimates/Metrics
		  • Issues, Risks, TBDs, Actions

CDR	• Review Panel
	• Customer Representatives
	• Developers
	• Test Team
	• CCB
	• Selected FSW Branch specialists
		• CDR Presentation Package:
		  • Updated Schedule & Staffing
		  • Design Overview
		  • Prototyping Results
		  • Operational Changes since PDR
		  • Software Component Changes since PDR
		  • Re-use Changes since PDR
		  • Testing Strategy Changes since PDR
		  • Required Resources
		  • Updated Estimates/Metrics
		  • Issues, Risks, TBDs, Actions

Review	Participants	Content

STRR	• Review Panel
	• Customer Representatives
	• Developers
	• Test Team
	• Selected FSW Branch specialists
		• TRR Presentation Package:
		  • Updated Schedule & Staffing
		  • System Test Results
		  • Acceptance Test Overview
		  • Test Readiness Assessment
		  • Updated Metrics

Acceptance Test Results Review (ATRR)	• FSW Maintenance Team • Developers • Customer Representatives	• Acceptance Test Results Package

4.1.13 Process Control

GPG 8072.1 establishes a consistent method for the control of production, installation, and servicing processes that directly affect the quality of products.

The specific implementation of GPG 8072.1, as applicable to this development project, is described by this Product plan.

4.1.14 Incoming Inspection and Test

No inspection other than kind, count, and condition of COTS purchased products is planned.

For procured items intended to be included in FSW, or to test FSW, the GSFC Receiving Inspection and Test System (RITS) will be used:

<http://rits.gsfc.nasa.gov/ritsindex.cfm>

4.1.15 Control of Test Equipment

During development, after the unit test stage, FSW is tested using a variety of hardware and software simulators of varying fidelity. The final pre-launch tests are run on the actual flight hardware. However, there are frequently some tests that cannot be performed on the flight hardware in a ground test environment. These functions can, therefore, only be tested using hardware or software simulators and other test equipment. In these cases the validity of the test depends on the fidelity of the test equipment. This section describes how this hardware and software test equipment will be controlled to ensure the validity and repeatability of such tests.

Note that lab test equipment and simulators provide only an interim level of testing. Integration and execution on flight hardware provide the basis for product acceptance.

The following table specifies how essential test equipment or test software is controlled:

[This example is from SDO – tailor as required]

Element	Description

Element	Description
Simulator – S-COMM SIM	
Hardware provided by:	SDO Project
Software provided by:	SDO Project
Hardware/software integrated by:	SDO Project
Fidelity validated by:	SDO Project
Configuration controlled by:	SDO Project
Simulator – BC SIM	
Hardware provided by:	SDO Project
Software provided by:	SDO Project
Hardware/software integrated by:	SDO Project
Fidelity validated by:	SDO Project
Configuration controlled by:	SDO Project
Simulator – RT SIM	
Hardware provided by:	SDO Project
Software provided by:	SDO Project
Hardware/software integrated by:	SDO Project
Fidelity validated by:	SDO Project
Configuration controlled by:	SDO Project
Goddard Dynamic Simulator (GDS)	
Hardware provided by:	Code 590/ SDO Project
Software provided by:	Code 590/ SDO Project
Hardware/software integrated by:	Code 590/ SDO Project
Fidelity validated by:	Code 590/ SDO Project
Configuration controlled by:	Code 590/ SDO Project
ASIST & Front-End Data System (FEDS)	
Hardware provided by:	SDO Ground System Group
Software provided by:	SDO Ground System Group
Hardware/software integrated by:	SDO Ground System Group
Fidelity validated by:	SDO Ground System Group
Configuration controlled by:	SDO Ground System Group
Breadboard and ETUs	
Hardware provided by:	Code 561/ SDO Project
Software provided by:	N/A
Hardware/software integrated by:	Code 582
Fidelity validated by:	Code 561/ SDO Project
Configuration controlled by:	Code 582

For those items listed above for which the FSW development team is responsible for fidelity validation, the following table specifies how the validation will be achieved:

Element	Fidelity Validation Strategy
Simulator – S-COMM SIM	N/A
Simulator – BC SIM	N/A
Simulator – RT SIM	N/A
Goddard Dynamic Simulator (GDS)	N/A
ASIST & Front-End Data System (FEDS)	N/A
Breadboard and ETUs	N/A

[If the FSW Development Team is responsible for any of these items, then describe how the item will be achieved, bearing in mind the following:

- If the test software already exists, does not require configuration, and is under configuration management, then it may be used as is.
- If the test software exists but must be configured, or if it must be developed, then it should follow the normal software development cycle.
- Once assembled, the test software must be checked against existing non-configurable test software (or hardware). If this is not possible, then the test software must be exercised with the software being tested in a cyclic manner until confidence is achieved.]

[Include the following statement:]

It is Code 582 policy not to conduct FSW testing with test equipment whose calibration is not current.

It is the FSW PDL's responsibility to examine the calibration sticker on each piece of Inspection, Measuring and Test Equipment (IMTE) to ensure that the calibration is current. If the calibration sticker has expired, or will expire before testing is complete, the PDL will arrange for recalibration so as to avoid impact to the testing schedule.

Addition details are contained in GPG 8730.1 (Calibration and Metrology), which is available at:

http://gdms.gsfc.nasa.gov/gdms/plsql/masterlist.menu

Power supplies and logic analyzers are the most typical items requiring calibration in our testbeds.

There is a company under contract to GSFC to provide calibration services and online storage of calibration equipment.

[Details of this service have not yet been finalized, however, the latest information is available from the 582 Calibration web page: http://fsw.gsfc.nasa.gov/internal/Calibration.html]

The FSW Lab Manager (or designee) will use this service to register all test equipment that can be calibrated, and maintain current calibration status.

4.1.16 Make/Buy Approach

[Identify which make/buy decisions will be made using a formal decision analysis process, such as a trade-study, that evaluates identified alternatives against established criteria. Reference (preferred) or describe any special purchasing strategies for items specified in Section 3.5. This may include strategies for use of COTS such as agreements for vendor modifications to address specific requirements. (Note that in most cases, open competitive procurement of hardware and software products is required. See GPR 5100.1 for additional information on procurements.)]

4.1.17 Prototyping Approach

[Describe any prototyping activities required to develop the product and the purpose of the prototype (i.e., "What specific questions are to be answered by the prototype?"). If the criteria to be used in evaluating the prototype are known, identify them here. Otherwise, itemize these criteria in the prototype's documentation.]

4.2 PROCESS FOR TRANSPORTATION, IDENTIFICATION, AND MEDIUM OF PRODUCT

[Describe the process for transporting a deliverable release from the development site(s) to the customer site. Consider the following items:

The following table describes the process for transporting a deliverable release from the development site(s) to the customer site:

Element	Details
When a release is available for delivery, how is the customer informed?	A WOA is prepared to load into hardware
Medium for delivery?	See Sections 2.12 (Medium for Product Delivery) and 2.13 (Product Destination)
How is the release identified?	Build and Version number
How is the VDD transmitted?	
Does the release require an installation procedure?	Details in the VDD
How is the installation procedure transmitted?	Details in the VDD
Is there documentation accompanying the release describing its functional capabilities and any known faults or restrictions (release notes)?	Yes - details in the VDD
How are the release notes transmitted?	Part of the VDD

See Section 2.8.2, Deliverables from FSW PDT for the destination and delivery medium of deliverable products.

4.3 TECHNOLOGY AND COMMERCIALIZATION PLAN

[Include or tailor the following statement:]

There is no technology and commercialization plan for the [Mission Acronym] FSW.

4.4 FSW MAINTENANCE

The arrangements for maintaining the software after Acceptance Test are contained in Section 2.14 (Post-Delivery Maintenance).

Printed copies of this document are for REFERENCE PURPOSES ONLY! The only controlled copy of this document is located on-line at http://fsw.gsfc.nasa.gov/internal/StandardsCCB/

5.0 PRODUCT ASSURANCE

This section describes the processes and procedures that will be followed in order to assure that the FSW satisfies the customer's requirements.

5.1 ASSUMPTIONS AND CONSTRAINTS

[List any assumptions and constraints that might affect the product assurance process. For example, if a customer-supplied testbed will be used to validate the developed software, we might have to assume that the testbed fidelity will be appropriate for that function.

"None" is an acceptable entry for this section.]

5.2 QUALITY ASSURANCE

[Reference the project's Software Assurance Plan (a.k.a. the Software Quality Assurance Plan) or describe the overall approach, criteria, and process for software quality assurance. Describe the interface and communication path between the FSW PDT and the external organization providing software quality support. Specific project characteristics and risks influence quality assurance, and assurance planning should be tailored to reflect this fact. How will product evaluation and process monitoring be accomplished? What level of support will the project have from the center Software Assurance organization, Code 300, and the NASA IV&V organization?

5.3 CONTROL OF NONCONFORMING PRODUCTS

During the development phase, reports of nonconformance will be reviewed, tracked, and maintained by the development team. An on-line problem/enhancement database system has been set up at:

<http://??????????????????>

Any problem or enhancement that impacts the schedule, budget, and delivery of the product will be assessed by the development team and reported to the customer.

The following procedure will be used to report, control, and correct FSW nonconformances:

- Any member of the team may fill out a Discrepancy or Change Request (DCR) against any FSW product or tool, via the online reporting system during any phase of the project.
- The system will forward any DCRs received to the PDL.
- The PDL will select an appropriate person to analyze the problem, determine corrective action, and notify all affected owners of other items.
- In the event of a disagreement over ownership of the discrepancy, the PDL will decide.
- After approval (if necessary), work scheduling, correction and retest, the FSW item owner will update the appropriate CM information (see Section 5.3).
- The owner of the item will maintain the status of the DCR in the team DCR database.

In addition, for FSW problems reported **after delivery of the final release to the customer** (or representative), the PDL will determine if the problem meets one or more of the criteria set forth in GPG 1710.1 (characterized as "major" non-conformances), and if so, will also enter the item in the Goddard Problem Reporting System (GPRS):

<http://gprs.gsfc.nasa.gov/>

The PDL will discuss with the customer if the software release can be used as is until the next release is available.

[Include the paragraphs above, or tailor them as necessary. Under certain circumstances it may be necessary to completely replace them, for example, if the Team is required to use a customer-supplied NCR system.

This item may be included by reference to an external Configuration Management Plan if appropriate.]

5.4 CORRECTIVE AND PREVENTATIVE ACTION

[Include or tailor the following:

Reports of nonconformance will be reviewed, tracked, and maintained by the development team. An assessment of the impact of the nonconformance to the schedule, budget, and delivery of the product will be made by the development team.

Nonconformances with potential impact to schedule, scope, or cost will be reported to the Project for approval of the proposed solution.

Nonconformances with no potential impact to schedule, scope, or cost will be repaired and tracked as described in Section 5.3 (Control of Nonconforming Products).

5.5 CONFIGURATION MANAGEMENT

[In this section, describe the mechanisms (usually computer assisted) for controlling source code and related products. Describe the following:

- Is a CM tool used to control access and maintain version information?
    - If so, which tool?
- When in the life-cycle are items placed under CM?
- Who is responsible for CM (designated individual, rotating responsibility)?
- In addition to source code, which other items are controlled in this way?

This item may be included by reference to an external Configuration Management Plan if appropriate.]

5.5.1 Identification and Traceability of Products

[Describe how delivered products can be identified and traced. Include the following considerations:

- Describe the numbering scheme used to label (or assign file/directory names to) products. Include numbering schemes for:
  - Releases
  - Software components of releases
  - Data components of releases
  - Procedure components of releases
- Describe the delivery letter (or equivalent) that accompanies a build/release delivery.
- Describe the VDD (or VDF) that is attached to the delivery letter.
- Describe the Release Notes (or equivalent) attached to the delivery letter.
- Note that for delivered releases (and non delivered builds) it must be possible to recreate the build/release from archived information, which implies the following:
  - The software components of the build/release are known to specific version numbers and archived.
  - “Make files” (or equivalent) exist for each component and for the whole system.
  - The version number of each software tool (compilers, link editors, code generation tools, etc.) that materially affects the FSW is known.
  - The software development environment that was used to create the FSW is still available (or can be recreated from the information in the previous bullet).
  - Procedures and data used to test the FSW (and its components) are known to specific version numbers and archived.
- Note that the delivered release must be maintained for as long as Quality Records are maintained.

This item may be included by reference to an external Configuration Management Plan if appropriate.]

5.5.2 Control of Customer Supplied Elements

[Briefly describe the approach that will be used to integrate any customer-supplied items (as specified in Section 2.8.2) required for the development and test of final product. Identify any assumptions concerning these items or their integration.]

5.6 DATA MANAGEMENT

The previous Section (and referenced Configuration Management Plan, if applicable) describes the control of code-related assets for which a formal CM system has been implemented.

The team will also develop a number of items which, while not requiring formal CM, will need to be version controlled, or simply preserved for reference. The Branch has developed a web-based team document repository for these items.

The following table is a master list of the document categories, and documents that the team will develop. This list is current at the time of writing, but additions may be made without revision to this document.

This table also describes whether or not the document is considered an ISO Quality Record, who is responsible for the document, when it is collected, and where it is archived. In most cases documents will be archived in the team repository unless they naturally exist in another database (e.g., DCRs).

In some cases documents will also be version controlled by the Project (e.g., major plans). Section 3.9 (List of Controlled Documentation) shows which documents are under Project CM. These documents will also be kept in the team repository to make them available to all FSB personnel.

Document	QR ?	Owner	Collected When?	Stored Where?
Acquisition Record:				
Purchase Request	Y	PDL	At time of purchase	Repository
RITS Entry	Y	PDL	After evaluation	GSFC RITS database
CM Record	Y	PDL/CMO	As needed	Team CM System (MKS)
Delivery Letter / VDD	Y	PDL (DTL if subsystems delivered separately)	Each delivery (internal or external)	Repository
Discrepancy/Change Request (DCR)	Y	PDL	Initiation + tracked to closure	Team CM System (MKS)
Estimate	Y	PDL	Initial estimate + each replan	Repository
ICD		PDL	Final	Repository
Inspection Artifact:				
Inspection Announcements	Y	DTL	Announcement	Repository
Inspection Packages	Y	DTL	Announcement	Repository
Inspection Actions	Y	DTL	During review (tracked to closure)	Team Action Item System
Requirements Doc. Review Records (1)	Y	DTL	During Review	Repository
Major Plan				
FSW Product Plan		PDL	Final	Repository
FSW CM Plan		PDL	Final	Repository
FSW Test Plan		TTL	Final	Repository

Document	QR ?	Owner	Collected When?	Stored Where?
Meeting Minutes	Y	PDL, DTL, TTL	Each meeting	Repository
Metrics	Y	PDL, DTL, TTL	Monthly (Status Review Package)	Branch Metrics Database
QA Artifact:				
Code 300 Audit Report	Y	PDL	When provided	Repository
IV&V Report	Y	PDL	When provided	Repository
GSFC NCR	Y	PDL	When provided	GPRS
Calibration Records for Team IMTE	Y	Lab. Manager	As needed	Repository?
Quality Record List	Y	PDL	Initially during Product Plan development; whenever updated	Repository
Requirements Document		PDL	Final	Repository
Review Package	Y	PDL, DTL, TTL	Life-cycle reviews	Repository
Review RFAs	Y	PDL	During Review, tracked to closure	Branch RFA database
Requirements Traceability Matix (RTM) Snapshot	Y	PDL, DTL	See Branch Requirements Management Process	Repository
Schedule	Y	PDL	Initial + each replan	Repository
Staff Plan / Budget	Y	PDL	Initial + each replan	Repository
Status Report	Y	PDL, DTL, TTL	Monthly (Branch)	Repository
Task Description (TOMS)	Y	PDL	Task initiation + each Task Mod.	Repository (?)
Tech. Note		PDL, DTL, TTL	When developed	Repository
Test Report				
Build Test Reports	Y	TTL	Per Build	Repository
System Test Reports	Y		As run	Repository
Trade Study	Y	PDL	Trade Study completion	Repository
Training Material:				
Required Training	Y	PDL	Product Plan development	Product Plan
Team individual training records	Y	Individual	At time of training	Branch database
Individual Role Training records	Y	Branch	Completion of project	Branch database + paper records
User Guide		PDT, DTL	Final	Repository
Waiver Request	Y	PDL	On approval	Document Waiver Appendix (documents created from templates), or repository

Document	QR ?	Owner	Collected When?	Stored Where?
Work Order Authorization (WOA)	Y	PDL	As needed	Repository

APPENDIX A ACRONYMS AND ABBREVIATIONS

ACS ..... Attitude Control System
AT ..... Acceptance Test
ATP ..... Acceptance Test Plan
ATRR ..... Acceptance Test Results Review
BB ..... BreadBoard
BOE ..... Basis of Estimate
C&DH ..... Control & Data Handling (Subsystem)
CCB ..... Configuration Control Board
CDR ..... Critical Design Review
CM ..... Configuration Management
CMP ..... Configuration Management Plan
CMS ..... Configuration Management System
CNE ..... (GSFC) Center Network Environment)
CPT ..... Comprehensive Performance Test
CPU ..... Central Processing Unit
COTS ..... Commercial Off-The-Shelf
CRM ..... Continuous Risk Management
DCR ..... Discrepancy or Change Request
DFD ..... DataFlow Diagram
DTL ..... Development Team Lead
ETU ..... Engineering Test Unit
FDC ..... Fault Detection and Correction
FOT ..... Flight Operations Team
FSB ..... Flight Software Branch (Code 582)
FSW ..... Flight Software
FTE ..... Full Time Equivalent
GNC ..... Guidance, Navigation and Control
GNCC ..... Guidance, Navigation and Control Center (Code 570)
GOTS ..... Government Off-The-Shelf
GPG ..... Goddard Procedures and Guidelines
GPRS ..... Goddard Problem Reporting System
GSFC ..... Goddard Space Flight Center
I&T ..... Integration & Test
IT ..... Information Technology

IAT ..... Independent Acceptance Test
IATP ..... Independent Acceptance Test Plan
ICD ..... Interface Control Document
IOC ..... Initial Operational Capability
IRB ..... Internal Review Board
ISD ..... Information Systems Division (Code 580)
IT ..... Integration Test
ITA ..... Independent Technical Authority
LM ..... Lab. Manager
NCR ..... NonConformance Report
ODC ..... Other Direct Charge
OO ..... Object Oriented
OOD ..... Object Oriented Design
ORR ..... Operational Readiness Review
PDH ..... Product Development Handbook
PDL ..... Product Development Lead
PDL ..... Program Design Language
PDR ..... Preliminary Design Review
PDT ..... Product Development Team
POC ..... Point Of Contact
QMS ..... (GSFC) Quality Management System
RTOS ..... Real-Time Operating System
SDP ..... Software Development Plan
SOW ..... Statement Of Work
SPS ..... Small Purchases System
SRR ..... Software Requirements Review
SRR ..... System Requirements Review
SSC ..... Support Service Contractor
STRR ..... System Test Readiness Review
RFA ..... Request For Action
RID ..... Review Item Disposition
TBD ..... To Be Determined
TL ..... Team Lead
URL ..... Uniform Resource Locator
VDD ..... Version Description Document
VDF ..... Version Description File

WBS.....Work Breakdown Structure

WOA ..... Work Order Authorization

APPENDIX B WAIVERS

The following table describes requested deviations from the content of the Product Plan Template. The Branch Head's signature on the Signature page indicates Branch review and acceptance of these deviations.

Para.	Description of Requested Deviation	Rationale for Requested Deviation

APPENDIX C MAPPING TO PRODUCT DEVELOPMENT HANDBOOK OUTLINE

The outline of this document was originally based on the Product Plan outline presented in Appendix A of the Code 580 Product Development Handbook (PDH), Rev. D.

Subsequently, the Product Plan outline in the Product Development Handbook changed with Rev. E. In parallel, the outline of Code 582's Product Plan template changed to better reflect 582's normal practices and procedures. As a result, the outline of this document is substantially different from the outline presented in the Product Development Handbook, though the intention remains the same.

In June 2005 ISD replaced the PDH Product Plan outline with the ISD Software Management Plan / Product Plan (SMP/PP) For Class B & C Software template.

The following table presents a mapping between the ISD SMP/PP outline and the contents of this document:

ISD SMP/PP Section	ISD SMP/PP Section Name	This Document Section Name	This Doc. Section
1.0	Introduction	Introduction	1.0
1.1	Background	Background and Scope	1.5
1.2	Document Organization	Document Organization	1.2
2.0	Customer Agreement	Customer Agreement	2.0
2.1	Customer Identification	Customer Identification	2.1
2.2	Customer Goals and Objectives	Customer Goals and Objectives	2.2
2.3	Customer Requirements	Requirements Sources	2.6
2.4	Customer Schedules		
2.5	Customer Deliverables	Deliverables from FSW PDT	2.8.2
2.6	Acceptance Criteria	Acceptance Criteria	2.10
2.7	Customer Training	Customer Training	2.11
2.8	Post-Delivery Maintenance	Post Delivery Maintenance	2.12
2.9	Customer-Supplied Elements	Receivables to FSW PDT	2.8.1
2.10	Customer Involvement	Customer Involvement	2.4
		Customer Communications	2.5
2.11	Customer Requirements Review & Update Process	Authority for Changes	2.9
3.0	Software Management Approach	FSW Management Approach	3.0
3.1	General Development Approach	General Development Approach	3.1
3.2	Resources Needed	Resources Required	2.7
		Staffing Profile	3.2
3.3	PDT Information	Team Details	3.3
3.3.1	PDT Charter	Team Charter	3.3.1
3.3.2	Organization	Team Organization Chart	3.3.2

ISD SMP/PP Section	ISD SMP/PP Section Name	This Document Section Name	This Doc. Section
3.3.3	Roles, Responsibilities, Authority, & Accountability	Roles, Responsibilities, Authority, & Accountability	3.3.4
3.3.4	Stakeholder Involvement	Stakeholder Involvement	3.3.7
3.3.5	Stakeholder Commitment	Stakeholder Commitment	3.3.8
3.3.6	Training Plan	Team Training Plan	3.6
3.4	Procurement	Procurement	3.5
3.5	Risk Management	Risk Management	3.7
3.6	Software Safety	Software Safety	3.12
3.7	Software Security & Privacy	Security	3.4.3
3.8	Independent Verification & Validation (IV&V)		
3.9	Review Program	Reviews Planned	4.1.12
3.10	Overall Schedule	Schedules	3.8
3.11	Status Tracking	Status Tracking	3.13
3.12	Data Management (DM)		
3.13	Project Measures	Process & Product Metric Analysis	3.10
3.14	Key Issues, Decisions, and Rationale	Development Journals	4.1.4
3.15	Lessons Learned	Development Journals	4.1.4
4.0	Software Technical Approach	Technical Approach	
4.1	Derived Requirements		
4.2	Development Strategy	Software Development Plan	4.1
4.2.1	Development Life-Cycle	Life-Cycle	4.1.1
4.2.2	Development Process	Phases and Associated Products	4.1.2
		Methodology	4.1.5
4.2.3	Development Environment	Development and Test Environment	4.1.6
4.2.4	Make/Buy Approach	Make/Buy Approach	4.1.16
4.2.5	Customer-Supplied Products Approach	Control of Customer-Supplied Elements	5.3.2
4.2.6	Rights and Approvals	COTS/GOTS Products and Tools	4.1.8
4.2.7	Prototyping Approach	Prototyping Approach	4.1.17
4.3	Product Design		
4.4	Build Approach	FSW Build Strategy	4.1.9
4.5	Verification and Validation	FSW Inspection and Test Approach	4.1.10
4.5.1	Product Verification	FSW Inspection and Test Approach	4.1.10
4.5.2	Statistical Techniques	Forward	Forward
4.5.3	Incoming Inspection and Test	Incoming Inspection and Test	4.1.14
4.5.4	Product Validation	FSW Inspection and Test Approach	4.1.10
4.6	Peer Review/Inspection Process	FSW Inspection and Test Approach	4.1.10

ISD SMP/PP Section	ISD SMP/PP Section Name	This Document Section Name	This Doc. Section
4.7	Documentation	Control of Quality Records	5.5
		Control of Documents and Data	5.6
4.8	Product Delivery	Process for Transportation, Identification, and medium of Product	4.2
4.9	Product Maintenance	FSW Maintenance	4.4
5.0	Product Control and Assurance	Product Assurance	5.0
5.1	Configuration Management (CM)	Configuration Management	5.7
5.2	Control of Nonconforming Products and Corrective Action	Control of Nonconforming Products	5.3
		Corrective and Preventative Action	5.4
5.3	Control of Test Software and Hardware	Control of Test Equipment	4.1.15
5.4	Control of Customer Supplied Products	Control of Customer-Supplied Elements	5.7.2
5.5	Software Quality Assurance	Quality Assurance	5.2
Appendix A:	Acronyms and Abbreviations	Acronyms and Abbreviations	Appendix A
Appendix B:	System/Subsystem Classification	System/Subsystem Classification	Appendix D
Appendix C	Tailoring Matrix for Compliance with NPR 7150.2	Tailoring Matrix for Compliance with NPR 7150.2	Appendix E

APPENDIX D SYSTEM/SUBSYSTEM CLASSIFICATIONS

[Identify the classification of the overall software system in accordance with the software classification definitions for Class B and C software in Appendix B of NPR 7150.2. List the subsystems that comprise the system and identify the software classifications of each. Uniquely identify/highlight any subsystems containing safety-critical software.]

Software System	**Subsystem** Name	**Class (A-H)**	**Safety-Critical?**
			[Y/N]

APPENDIX E TAILORING MATRIX FOR COMPLIANCE WITH NPR 7150.2

This appendix contains the [Project Acronym] FSW compliance matrix against the numbered, project-level software engineering (SWE) requirements in NPR 7150.2, including those requirements delegated to other parties or accomplished by contract vehicles. Compliance is marked with and "X" in the appropriate Class B and C columns, as shown in Appendix D of NPR 7150.2

[Columns should be added for any software in Classes D to H.

If there are any variants, waivers, or exceptions to the requirements specified in NPR 7150.2, identify these in the right-hand column. These tailoring variations must be approved by the designated ITA. If a requirement may be met by following a Center-defined process (indicated by "P(Center,)" the applicable GSFC/ISD process asset has been identified.]

Section of NPR	Requirement Descriptor	SWE Rqmt	Class B	Class C	Class *[y]*	Tailoring Variants, Waivers or Exceptions
Preface	Effective Date	1	**X**	**X**		
Compliance with Laws, Policies, & Requirements	SW Disclosures	7	**X**	**X**		
	Export Control	8	**X**	**X**		
	External Release	9	**X**	**X**		
	Security	10	**X**	**X**		
	Disabilities	11	**X**	**X**		
	Disabilities	12	**X**	**X**		
SW Life Cycle Planning	SW Plan	13	**X**	**X**		
	Execute Plan	14	**X**	**X**		
	Cost Estimation	15	**X**	**X**		
	Schedule	16	**X**	**X**		
	Training	17	**X**	**X**		
	Reviews	18	**X**	**X**		
	Life Cycle	19	**X**	**X**		
	SW Classification	20	**X**	**X**		
	SW Classification changes	21	**X**	**X**		
	SW Assurance	22	**X***	**P (project)**		As defined in this Product Plan.
	SW Safety	23	**X**	**X**		
	Plan Tracking	24	**X**	**X**		
	Corrective Action	25	**X**	**X**		
	Changes	26	**X**	**X**		
Off-the-Shelf (OTS) SW	COTS, GOTS, MOTS	27	**X**	**X**		
Verification &	Verification planning	28	**X**	**X**		
	Validation planning	29	**X**	**X**		

Section of NPR	Requirement Descriptor	SWE Rqmt	Class B	Class C	Class *[y]*	Tailoring Variants, Waivers or Exceptions
Validation	Verification results	30	**X**	**X**		
	Validation results	31	**X**	**X**		
Project Formulation	CMM L3 or CMMI L2	32	**X****	**P (Center)**		
	Options for Acquisitions	33	**X**	**X**		
	Acceptance Criteria	34	**X**	**X**		
	Supplier Selection	35	**X**	**X**		
	SW processes & tasks	36	**X**	**X**		
	Milestone	37	**X**	**X**		
	Acquisition planning	38	**X**	**X**		
Government Insight	Insight into test	39	**X**	**P (Center)**		GPG 5100.1, "Procurement"
	Electronic access	40	**X**	**P (Center)**		GPG 5100.1, "Procurement"
	Open source	41	**X**	**P (Center)**		GPG 5100.1, "Procurement"
	Source code access	42	**X**	**P (Center)**		GPG 5100.1, "Procurement"
Supplier Monitoring	Track change request	43	**X**	**P (Center)**		GPG 5100.1, "Procurement"
	SW measurement data	44	**X**	**X**		
	Joint audits	45	**X**	**X**		
	SW schedule	46	**X**	**X**		
	Traceability data	47	**X**	**P (Center)**		GPG 5100.1, "Procurement"
	Solicitation	48	**X**	**X**		
SW Requirements Development	Document	49	**X**	**X**		
	SW requirements	50	**X**	**X**		
	Flow-down & derived req.	51	**X**	**X**		
	Bi-directional trace	52	**X**			
SW Requirements Management	Manage req. change	53	**X**	**X**		
	Corrective action	54	**X**			
	Requirements Validation	55	**X**	**X**		
SW Design	Document design	56	**X**	**P (Center)**		GPG 8700.5, "In-House Development & Maintenance of Software Products"
	Architecture	57	**X**	**P (Center)**		GPG 8700.5
	Detailed design	58	**X**			
	Bi-directional trace	59	**X**			
	Design ➔ code	60	**X**	**X**		

Section of NPR	Requirement Descriptor	SWE Rqmt	Class B	Class C	Class *[y]*	Tailoring Variants, Waivers or Exceptions
SW Implementation	Coding standards	61	**X**			
	Unit test	62	**X**	**X**		
	Version description	63	**X**	**P (Center)**		FSB VDD Template
	Maintain traceability	64	**X**			
SW Testing	Plan, procedures, reports	65	**X**	**X**		
	Perform testing	66	**X**	**X**		
	Test for compliance	67	**X**	**X**		
	Evaluate test results	68	**X**	**X**		
	Doc. defect & track	69	**X**	**X**		
	Models, simulations, tools	70	**X**			
	Update plans & procedure	71	**X**	**X**		
	Maintain traceability	72	**X**	**X**		
	Platform or hi-fidelity simulation	73	**X**	**X**		
SW Operations Maintenance, & Retirement	Document Maintenance plans	74	**X**	**X**		
	Plan ops, Maint. & Retirement	75	**X**	**X**		
	Implement plans	76	**X**	**X**		
	Deliver software product	77	**X**	**X**		
	As-built documentation	78	**X**			
SW Configuration Management	Develop CM plan	79	**X**	**X**		
	Track & evaluate changes	80	**X**	**X**		
	Identify SW configuration items	81	**X**	**X**		
	Authorizing changes	82	**X**			
	Maintain records	83	**X**	**X**		
	Configuration audits	84	**X**			
	Implement procedures	85	**X**	**X**		
Risk Management	Continuous Risk Management	86	**X**			
Peer Reviews	Requirements & Test plan	87	**X**	**P (Center)**		
	Checklist, criteria, & tracking	88	**X**	**P (Center)**		
	Basic measures	89	**X**			
	Objectives	90	**X**	**X**		

Section of NPR	Requirement Descriptor	SWE Rqmt	Class B	Class C	Class *[y]*	Tailoring Variants, Waivers or Exceptions
SW Measurement	SW measurement areas	91	**X**	**P (Center)**		
	Collection & storage	92	**X**	**X**		
	Analyze data	93	**X**	**P (Center)**		
	Report analysis	94	**X**	**P (Center)**		
SW Documen-tation Requirements	SW Development Mgt. Plan	102	**X**	**P (Center)**		FSB Product Plan Template
	SW Configuration Mgt. Plan	103	**P (Center)**	**P (Center)**		FSB CM Plan Template
	SW Test Plan	104	**X**	**P (Center)**		
	SW Maintenance Plan	105	**P (Center)**			
	SW Assurance Plan	106	**X**			
	SW Requirements Spec.	109	**X**	**P (Center)**		
	SW Data Dictionary	110	**P (Center)**			
	SW Design Description	111	**X**	**P (Center)**		
	Interface Design Description	112	**X**	**P (Center)**		
	SW Change Request/ Problem	113	**X**	**P (Center)**		
	SW Test Procedures	114	**X**	**P (Center)**		
	SW Users Manual	115	**X**			
	SW Version Description	116	**X**	**P (Center)**		FSB Delivery Letter Template
	SW Metrics Report	117	**X**	**P (Center)**		
	SW Test Report	118	**X**	**P (Center)**		
	SW Inspection / Peer Review	119	**P (Center)**			
Compliance	Compliance Matrix	125	**X**	**X**		This is the compliance matrix for the project.

* This requirement can only be waived by the OSMA ITA.

** For Class B software, in lieu of a CMM/CMMI certification, the project will conduct a software capability evaluation in the seven process areas listed in SWE-32 and mitigate any risk, if deficient.